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SPHERE

PAE TEST REPORT
Science Data Flow Operations

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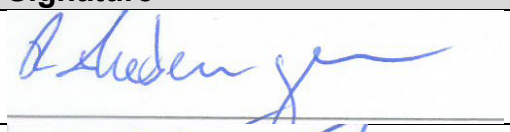
Author	Ralf Siebenmorgen Markus Kasper Dimitri Mawet	20.11.2013	
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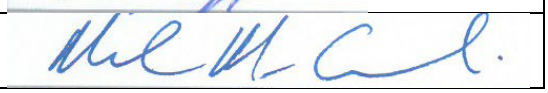
Releaser	Mark Casali	06.12.2013	

REVIEWERS

Reviewers	Affiliation, Division

CHANGE RECORD

ISSUE	DATE	SECTION/PARA. AFFECTED	REASON/INITIATION DOCUMENTS/REMARKS
0.0	20.10.13	All	Initial draft (RSI)
0.1	27.10.13	All	Complete draft (RSI)
0.2	03.11.13	All	Updates/corrections + performance (DMA)
0.3	14.11.13	All	NCPA + AO (MKa)
1	20.11.13	All	…for approval (RSi)

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1 Scope

This document describes the PAE tests that were executed following the test plan (R2) for all science data flow operational issues. Other operational issues related to engineering procedures such as: switch-on and shut-down tasks of the SPHERE instrument and its subsystems, health checks, stability issues of wheel movements, etc., and procedures described in the Operation Manual are not part of this document.

During the test of the science data flow system, experts were present from the Consortium. For DRH/pipeline an expert for each subsystem and Markus Feldt, and for BOB/template an expert for each subsystem and David Mouillet, as the SPHERE Instrument Scientist was present. They provided the required introduction and support for the ESO reviewers. From ESO Ralf Siebenmorgen, Markus Kasper, and Dimitri Mawett (ESO) performed the tests.

Data taken during these PAE test were processed with the pipeline. All these raw data as well as all pipeline products are compiled into a data package for each subsystem. After PAE when the instrument is working in the integration hall at Paranal we will re-do the tests executing identical OBs and data reduction recipes. Then the data obtained at Paranal can be compared with the lab results obtained in this document before deciding to start the nighttime calibrations. For this reason we include all the required details in the appendix A: for OB and appendix B: for the DRH reduction scripts. We conclude with a summary of the main DFO actions that need to be closed before start of nighttime commissioning.

2 List of Abbreviations & Acronyms

This document employs several abbreviations and acronyms to refer concisely to an item, after it has been introduced. The following list is aimed to help the reader in recalling the extended meaning of each short expression:

2MASS	Two Micron All Sky Survey
AO	Adaptive Optics
DFO	Data Flow Operations
DRH	Data Reduction Handling
P2PP	Phase 2 Proposal Preparation Tool
TBC	To Be Clarified
TBD	To Be Defined

3 List of Applicable and Referenced Documents

R1	Top-Level Requirements for the SPHERE	VLT-SPE-ESO-
R2	PAE Test Plan for SPERE Science Data Flow Operations	VLT-PLA-ESO- Ralf Siebenmorgen

4 Review of panels

◦ Visual inspection of GUIs

▪ Verify that all status and health information, functions and panels useful in operations are present and clear

▪ Check functionality of the OS and ICS panels and take simple calibs with ICS+NGC panels

▪ "Review" user manual for INS SW

All these manual verifications were performed. GUIs are well done and functional, especially the SAXO RTD which contains all useful information about loop feedbacks (ITTS, DTTP, PTTM, WFS, etc.). There is however some additional work to do to bullet-proof panels for operations. Clear specifications were identified and discussed:

ACTIONS:
1.- SAXO RTD: add Strehl ratio from Sparta RTC, add guide star magnitude estimate (to be recalibrated during commissioning), make the main loop parameters visible (WFS frequency, SF, OMGI plot, add alarm for Kalman filter).

2.- SOS panel: make it more “useful” a la SINFONI (good example). “safe state”, “close loop” buttons shall be implemented, etc. Tabs relaying critical Saxo parameters shall be implemented (Strehl ratio, guide star magnitude, etc.)

3.- 2 screens are not sufficient (space taken by SCIENCE instrument GUIs is too big to be manageable with 2 screens). D. Mawet will ask Andrew Wright (MCR) about getting additional screens and/or terminals. N. Schuhler suggest 2 terminals, each with 2 screens.

5 Templates verification

1. Verify that all templates that are in the template design document exist.

2. Ensure that template signature files can be read in P2PP.

3. For some templates the execution shall be exemplified by taking short exposures.

4. After execution the fits header shall be inspected and some relevant keywords extracted.

5. Further tests are done using p2pp/BOB. For the following templates ingest them into P2PP and run a test OB:

- Verify all calibration templates as described in the SPHERE calibration plans.
- Verify all technical templates as described in the SPHERE calibration plans.
- Verify all science templates as described in the SPHERE User Manual.

All these manual verification were performed without further actions.

More important here is the execution of the templates by OBs starting from P2PP level. These are described below in Sect. 10.

6 Dictionary

A review of the SPHERE dictionary was performed. There were technical problems reported by head of DICB. The first version included too specific keywords that are not of interest for the general user and shall be moved to a log file.

Manual verification of the dictionary as installed on the instrument pipeline as of today were performed and result in action.

Action: Improve quality of the dictionary. *This shall be done according to email by Adam (a) solving some technical inconsistencies, such as avoiding acronyms in the label of the fits header, including the correct units of the parameter and b) moving keywords that are irrelevant for the outside astronomers into the ops log. What to do to perform this action was clarified and explained to the Consortium*

7 QC parameters

A review of the SPHERE QC parameters was performed again. The QC parameters were extracted form the pipeline produced fits headers and compared to what is documented in the DRH Manual. During early PAE tests it was identified that there were too many (a few hundreds) QC parameters processed and stored in the fits headers of the pipeline products.

The number of QC parameters was now found to be limited to a few so that meaningful instrument monitoring becomes possible. For example IRDIS produces now just 5 QC parameters for dark and many more for flats and distortion map. For the distortion may be only x, y is important the others could go into a log-file. For the star_center recipe the QC is the same as for the flat field while again only x, y position of the star center is important, etc.

Therefore we decided to send all QC parameters to the QC scientist at ESO/Garching for final approval/review. A comprehensive list of QC parameters including a short description is available at:

http://www.mpia-hd.mpg.de/SPHERE/TestStatus/sphere.mpia-hd.mpg.de/index.html

It was also noticed that several QC parameters are missing (e.g. photometric zero points for IRDIS and ZIMPOL) or not yet defined (Strehl ratio, static and dynamic contrast). All of them should in principle be measured every day at the startup of the instrument (by replaying some recorded turbulence sequences on the DM for the dynamic part), and during the night by using the photometric STD OBs (for statistical analysis).

Action:
1.- QC parameters under review by W. Hummel (ESO QC scientist).
2.- M. Feldt will look into photometric zero point recipes for IRDIS and ZIMPOL's broadband filters (SPHERE TRAC #410).
3.- We (D. Mouillet, R. Siebenmorgen, M. Kasper, N. Hubin, J. O'Neal, N. Schuhler, M. Feldt) have agreed on the need for a set of metrics relevant to SPHERE

a.- Strehl ratio: current recipe "irplib_strehl.c" (used for NACO as DRH pipeline routine generating Strehl QC parameter, in CPL for INS CheckAO startup template) is not appropriate for SPHERE. A new recipe shall be implemented per ONERA specification. IDL routine to be sent by JF Sauvage to D. Mawet for review, then to M. Feldt for implementation as DRH recipe.

b.- Contrast is the preferred metric for SPHERE. There is no existing recipe currently available to compute contrast curves, and contrast metric. Action taken in the form of SPHERE TRAC change request #411.
Specification of new contrast routines to be sent by IS team to M. Feldt for implementation. Baseline routine for contrast curve is A. Vigan's IDL script, already in use in the consortium (for uniformity).

4.- Contrast can be measured at different steps of the data taking and reduction process. QC0 shall be performed with the minimum processing possible, and thus be as close as possible to raw data. It was decided to baseline average rms contrast (robust sigma) between 5 and 17 lambda/D for IRDIS and ZIMPOL as a good starting point (to be confirmed as a post-PAE/commissioning action). As instrument monitoring, raw contrast shall be measured:

- with internal calibration sources => static aberration monitoring.
- with internal calibration sources/replaying turbulence sequences on the DM (Sparta functions) => dynamic loop behavior monitoring.

8 DFO Documentation status

The DFO documentation package include the:

1. User Manual
2. Operations manual
3. ETC and the
4. Calibration plans, and

5. Commissioning plans.

We reviewed above documents against the RIXs that were raised during the PAE process. All RIXs were answered to, and documentation updated accordingly. We note the significant effort in complying with the reviewer requests, especially with the Ops man.

ACTIONS:

1. Concerning the User Manual/Ops Manual/Calibration plans, the list of modes offered will need to be revised after commissioning (right now, P2 modes are included in the UM).
2. Commissioning plan to be revised according to PAE.

9 ETC

The ETC interface pages and descriptions are ready for IRDIS in some configurations. We agreed that the design and structure is at it should be and the same structure shall be applied to the other instrument configurations later. In the ETC output additional warnings shall be given, e.g. saturation limits, and that the contrast curves are computed at 5σ detection limit. The output curves shall include a larger range that is highlighted by a shaded area of say +/-30% (TBC) of the computed mean curves. This shall indicate the detection range that the observatory might be able to guaranty.

We identified several bugs in the computations that need to be corrected. For ease of bug fixing purposes a verbose ETC version is required. Such ETC version shall be made available to the Consortium so that they can debug the computations.

Thereafter the ETC may be populated to scope with other instrument configurations.

Action:
1.- Clean up the ETC out put and provide a debugging version of the ETC (high verbose level needed from Klara to DMO).
2.- After bug fixing get ETC populated by all other instrument configurations. USD scientist should be consulted.
3-. Add uncertainty on contrast curves.

10 End-to-end science test

Template driven data were taken, RTD windows inspected and data analysed by the SPHERE pipeline (see Sect.11) The pipeline recipes that are tested by these data are identical to the one described in the example cases in the DRH Manual, which were already verified against another data set in June before the PAE tests detailed in this document.
The RTD panels appear quite similar as for IRDIS for which examples are displayed in Fig.1-4 in Sect.10.2.

10.1 IFS

We concentrate on IFS also the instrument is ready to observe simultaneously with IRDIS. First we ensured that SAXO RTD indicates that it is illuminated, and then we executed the following templates and recipes:

Pipe recipe	Template name	OB duration
sph_ifs_master_dark	irdifs_cal_dark	15
sph_ifs_master_detector_flat	irdifs_ifsflat	3
sph_ifs_spectra_positions	irdifs_specpos	3
sph_ifs_wave_calib	irdifs_calwave	3
sph_ifs_instrument_flat	irdifs_ifsflat	3
sph_ifs_science_dr	irdifs_obs_flux irdifs_obs_exp_NIROBS	5 (corono mask off) 30 (deep)

10.1.1 IRDIFS-NIROBS calibrations

We take in that calibration OB various calibration templates:

- irdifs_cal_dark,
- irdifs_cal_flats,
- irdifs_cal_specpos,
- irdifs_cal_ifsflat, and
- irdifs_cal_wave

This OB is for the calibration observations in the wavelength range <1.35µm. Details of the settings in that OB are given in Appendix A. By execution, while switching on the white lamp, a failure occurred and BOB exit with error message. Switching the Lamp by hand ON cured the problem and OB was run smoothly.

10.1.2 IRDIFS_OBS_exp_NIROBS science observations

The following templates are executed in that OB:

- irdifs_acq,
- irdfis_obs_flux,
- irdfis_obs_star_center,
- irdfis_obs_exp_NIROBS

This OB is for the science observations in the wavelength range <1.35µm. During execution of the last template a failure occurred. In the ICS we noticed that IFS was put into simulation mode. It was fixed by support of the system engineer: a reboot of the workstation was necessary as too many ghost processes were running.

10.1.3 IRDIFS-ifs-H calibrations

We take in that calibration OB various calibration templates:

- irdifs_cal_dark,
- irdifs_cal_flats,
- irdifs_cal_specpos,
- irdifs_cal_ifsflat, and
- irdifs_cal_wave

This OB is for the calibration observations in the wavelength range >1.35µm. Details of the setting in that OB are given in the Appendix A. The OB runs smoothly.

10.1.4 IRDIFS-ifs-H-science observations

The following templates are executed in that OB:

- irdifs_acq,
- irdfis_obs_flux,
- irdfis_obs_star_center,

- irdfis_obs_exp_NIROBS

This OB is for the science observations in the wavelength range >1.35μm.

10.2 **IRDIS**

Templates verified are:

Pipe recipe	template name	OB duration
sph_ird_master_dark	irdifs_cal_dark	15
sph_ird_instrument_flat	irdifs_cal_flat	15
sph_ird_distortion_map	irdifs_cal_distmap	5
sph_ird_star_center	irdifs_obs_star_center	5
sph_ird_science_dbi	irdifs_obs_flux irdifs_obs_exp_NIROBS	5 (corono mask off) 30 (deep)

10.2.1 Calibration OB

Choice of filter combination used is called: db_ndH23

Templates: *irdis*_cal_background
irdis_cal_flat
irdis_cal_distmap

These are calibrations for:

- background (=dark),
- flats, linearity and bad pixel map
- distortion map

The result of the distortion map as displayed on the RTD is shown in Fig.1.

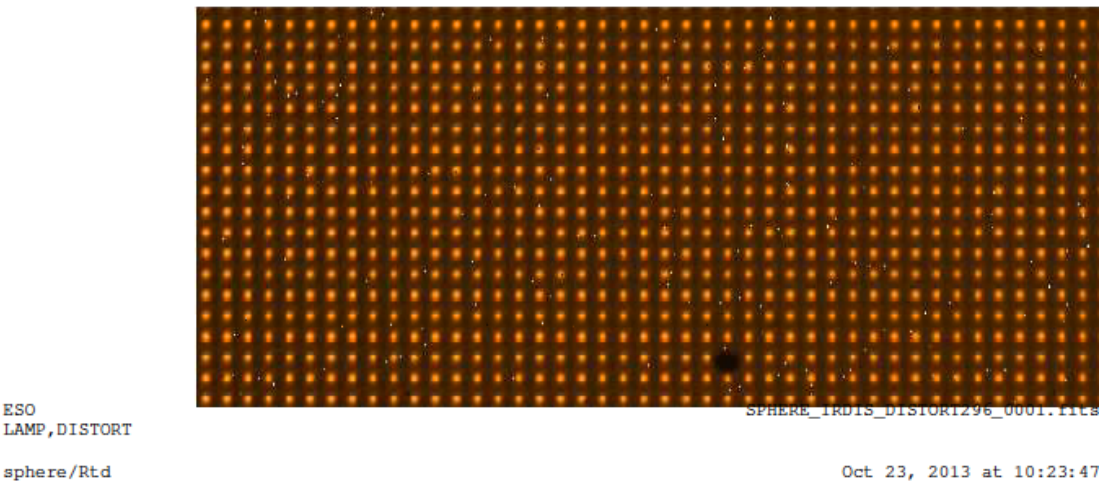


Figure 1: RTD view of the distortion map

10.2.2 Acquisition template:

Template *irdis*acq_*imaging*: runs without error/ warnings

For example the result of centring of the internal source (that is inside the system, after turbulence simulator) is inspected with the RTD and displayed in Fig.2. In the observations the source is well centred as can be seen by the brightness distribution of the image, which appears indeed quite symmetric (Fig.2).

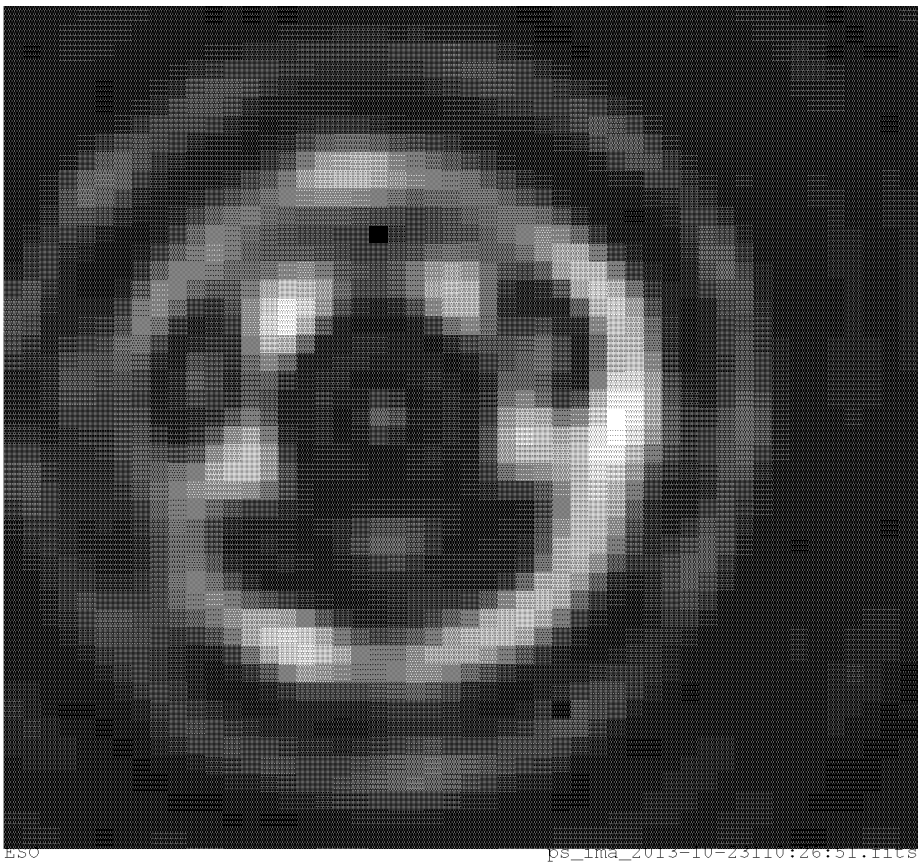


Figure 2: Display of source centring on coronagraph after centring during the acquisition sequence.

10.2.3 Observations*:* IRDIS_-_DBI_-_NDH23+NH32

We run observing block “IRDIS_-_DBI_-_NDH23+NH32”, all run smoothly. In Figure 3 we display the RTD image of the last observing template in that OB, which is called: *irdis_obs_flux.*

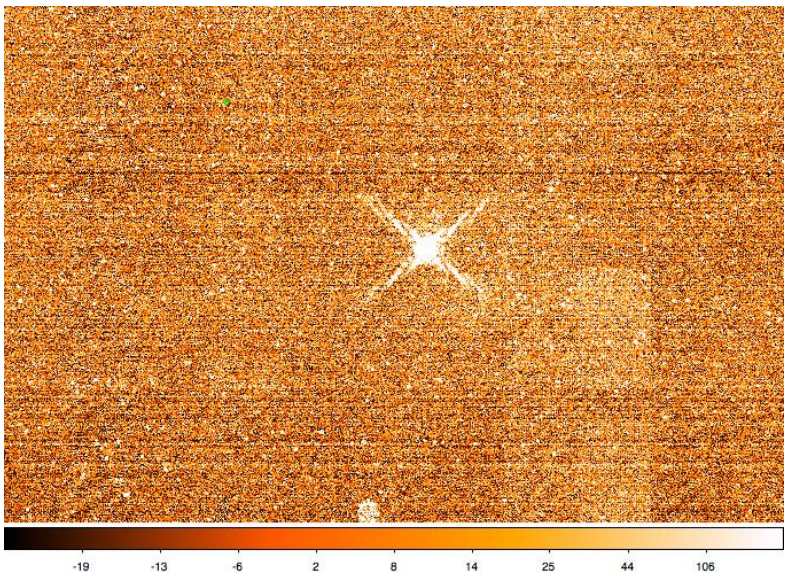


Figure 3: Off axis PSF for peak flux measurement

10.2.4 OB IRDIS-DBI-J23

We run again calibration and observing templates. This is a test with a different choice of filters combination called db_J23. Again calibration templates for background, flat fields, linearity, etc. are run with instrument set-up details as listed in Appendix: IRDIS-DBI-J23-cal for the calibrations and IRDIS-DBI-J23-obs for the science observations, respectively. In the latter the acquisition template and observing templates were executed. During the acquisition we also executed a focus check that takes an additional ~10min. observing time.

Templates executed:

- _irdis_acq_imaging
- _irdis_obs_star_center
- _irdis_obs_exp_dbi

During the sequence the RTD of SAXO was verified and discussed.

10.2.5 OB for classical imaging

Following OBs for calibration and science observations are executed for classical imaging.

- IRDIS_-_CI_-_H_-calib.obx
- IRDIS_-_CI_-_H_-obs.obx

The detail set-up of instrument parameters is given in the Appendix. The OB run without any error messages and data are analysed by the pipeline (see Sect.11 below).

10.2.6 OB for spectroscopy

Following OBs for calibration and science observations are executed for low (LRS) and medium (MRS) spectroscopy.

- IRDIS_-_MRS_-calib.obx
- IRDIS_-_MRS_-obs.obx
- IRDIS_-_LRS_-calib.obx
- IRDIS_-_LRS_-obs.obx

The detail set-up of instrument parameters is given in the Appendix.
In Fig. 4 we display an image taken form the RTD during the acquisition sequence of the LRS mode. In that figure the point source is clearly visible and its pattern is caused by the coronagraph and the slit. This image looks similar in LRS and MRS mode and are therefore not shown in this report.

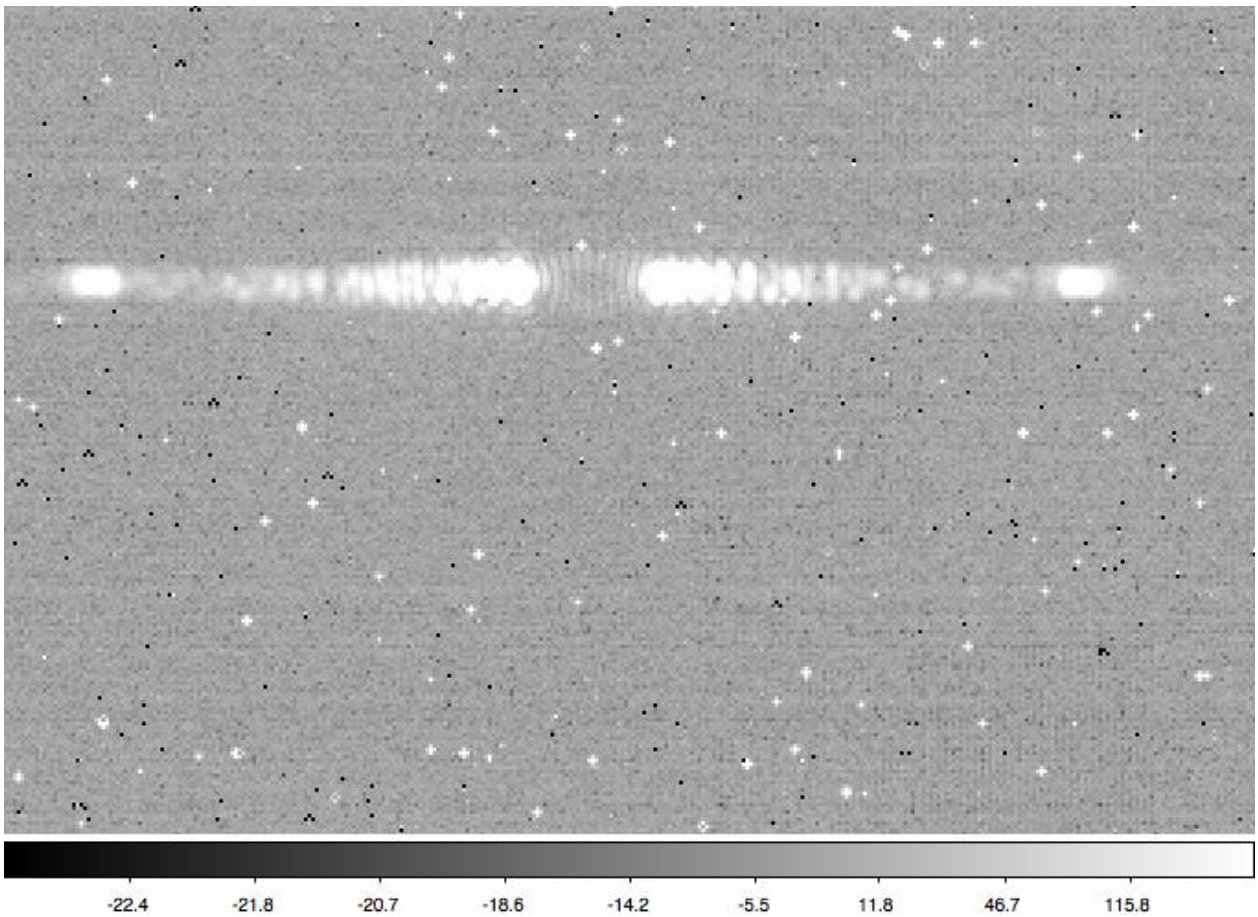


Figure 4: RTD snapshot during the acquisition sequence of the LRS and MRS mode.

The OB run without any error messages and data are analysed by the pipeline (see Sect.11 below).

10.3 **ZIMPOL**

Pipe recipe	template name	OB duration
sph_zpl_preproc	no	-
sph_zpl_master_bias	zimpol_cal_bias_pol	10
sph_zpl_master_dark		10
sph_zpl_intensity_flat	zimpol_cal_flat_pol	10
	zimpol_cal_modem_poleff	5
	zimpol_acq	15

sph_zpl_science	zimpol_obs_exp_polp2p3 zimpol_obs_exp_polp2p3	5 (no coro) 30 (deep)

We start the calibration and science observations OBs that are detailed in Appendix A. First, caused by a user error in the start-up procedure the calibration OB for FastPol did not run. After proper start-up of all panels (NGC, RTD, Quick look, ..) the OB run smoothly. There are calibration and science OB for FastPol, classical imaging, FastPol with four quadrant coronagraph, and SlowPol.

10.3.1 FastPol calibrations

This OB include templates:

- _zimpol_cal_bias_pol
- _zimpol_cal_flat_pol
- _zimpol_cal_modem_pol

10.3.2 FastPol science (BSGREY)

This OB includes acquisition and science observing templates in fast polarisation mode using the beam splitter and grey filter. Templates executed are:

- _zimpol_acq
- _zimpolobs_exp_pol

The science template is executed twice taking a short and a deep integration. In Figure 5 we display the RTD image during the science exposures. The one during the acquisition sequence appears similar. The same images also appear in the quick look tool.

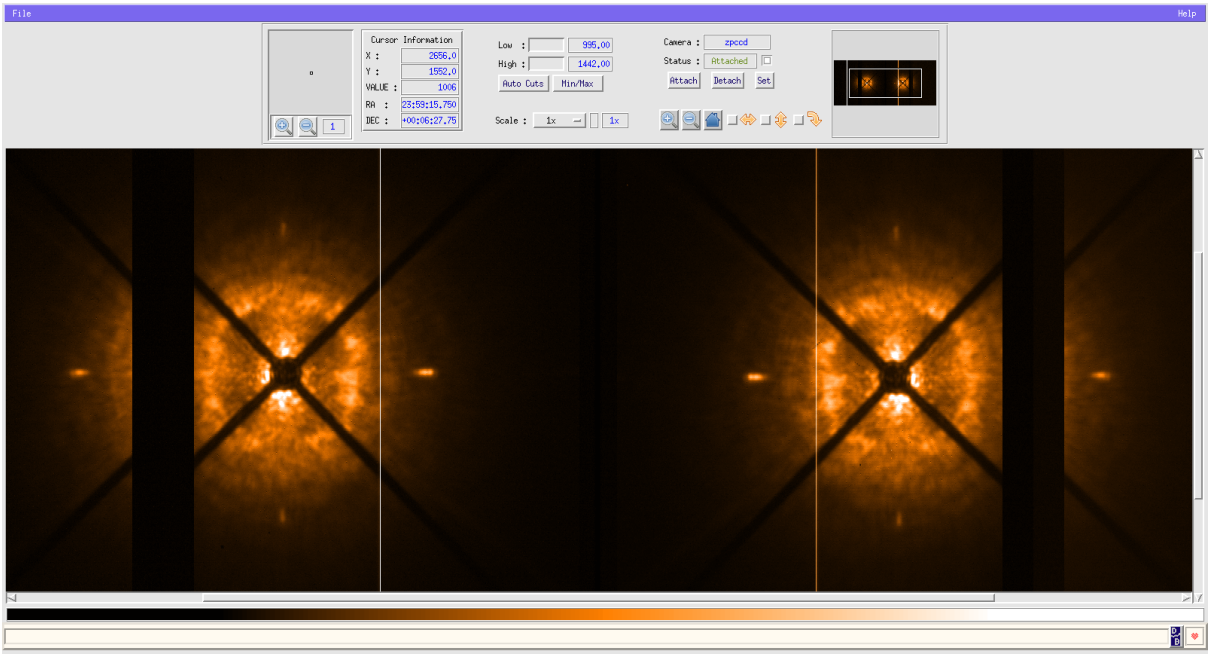


Figure 5: RTD image ZIMPOL during the FastPol science observing sequence.

10.3.3 Imaging calibrations

This OB include templates:

- _zimpol_cal_bias_pol
- _zimpol_cal_flat_pol

10.3.4 Imaging science

This OB includes acquisition and science observing templates in fast polarisation mode using the beam splitter and grey filter. Templates executed are:

- _zimpol_acq
- _zimpolobs_exp_img

The science template is executed in a single broadband filter and repeated in two filters using Brα with Hα. Thus the later template can be used for differential imaging. An image as displayed on the RTD during the first science template is shown in Figure 6.

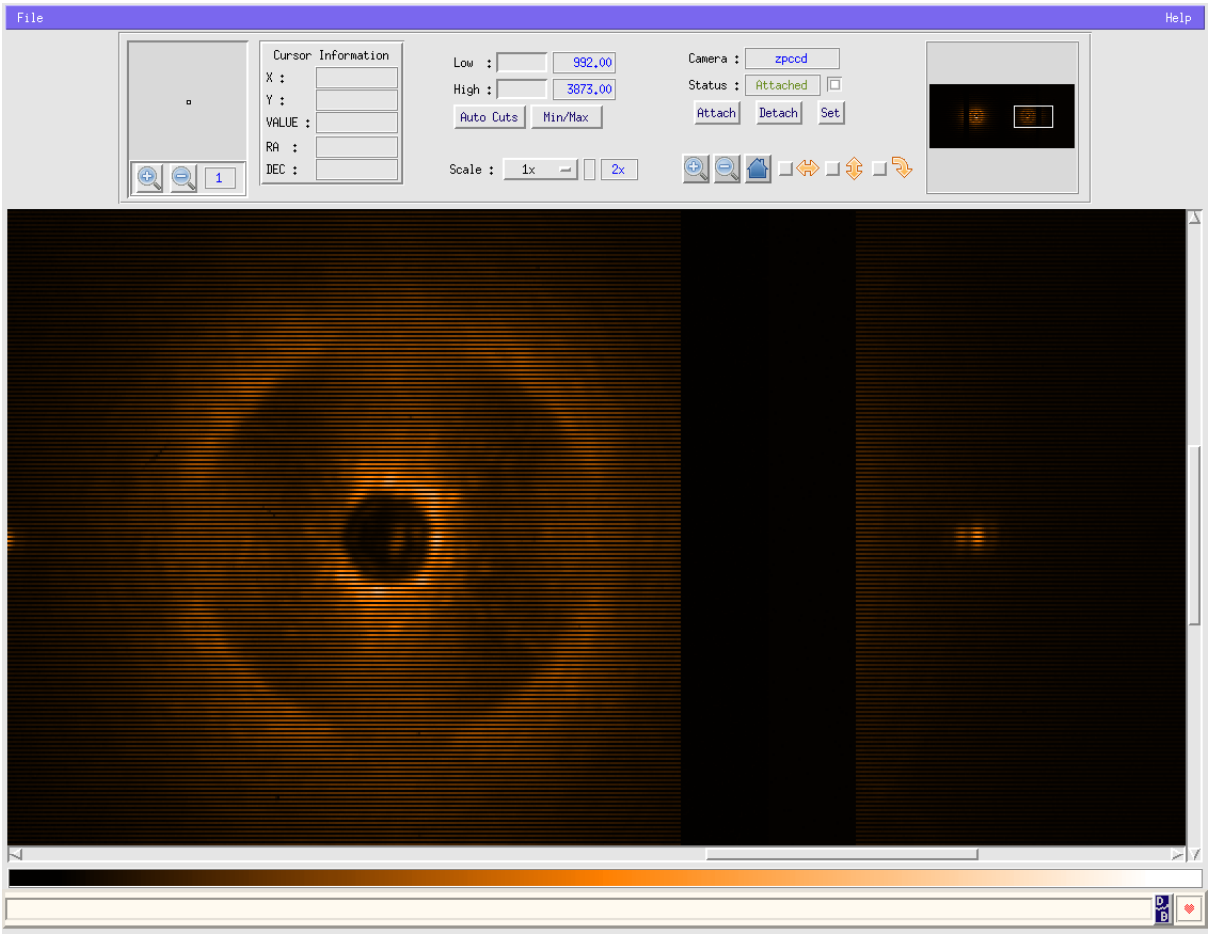


Figure 6: Image displayed on the RTD during the ZIMPOL imaging science sequence.

11 Pipeline verification:

11.1 IFS

The pipeline processed dark, flat, spectral positioning, and wavelength calibrations as well as science data of Sect.10. The DRH products were inspected. The QC parameters extracted from the fits headers of the pipeline products and sent to QC scientist for review. The data reduction scripts are attached to Appendix B. An error was identified showing that the wavelength recipe at the moment always takes its back-up solution and so applies a wavelength calibration as derived by design, instead of the one computed from the wavelength calibrations. Still the science observations are processed fine and for one wavelength we display one example image in Fig.7.

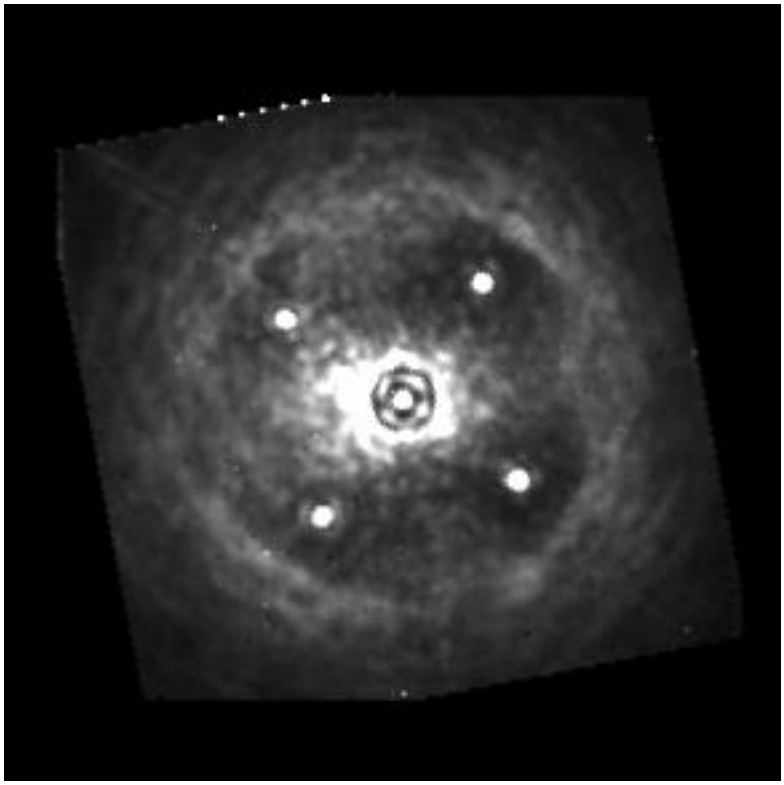


Figure 7: Final IFS data product showing a monochromatic image extracted from the data cube of the waffle.

11.2 **IRDIS**

Dark, flat (Fig.8), distortion data of Sect.11 were analysed and pipeline products inspected. The QC parameters are extracted from the fits headers of the pipeline products and sent to QC scientist for review. The data reduction scripts are attached to Appendix B. Detail comments to individual recipes are given below.

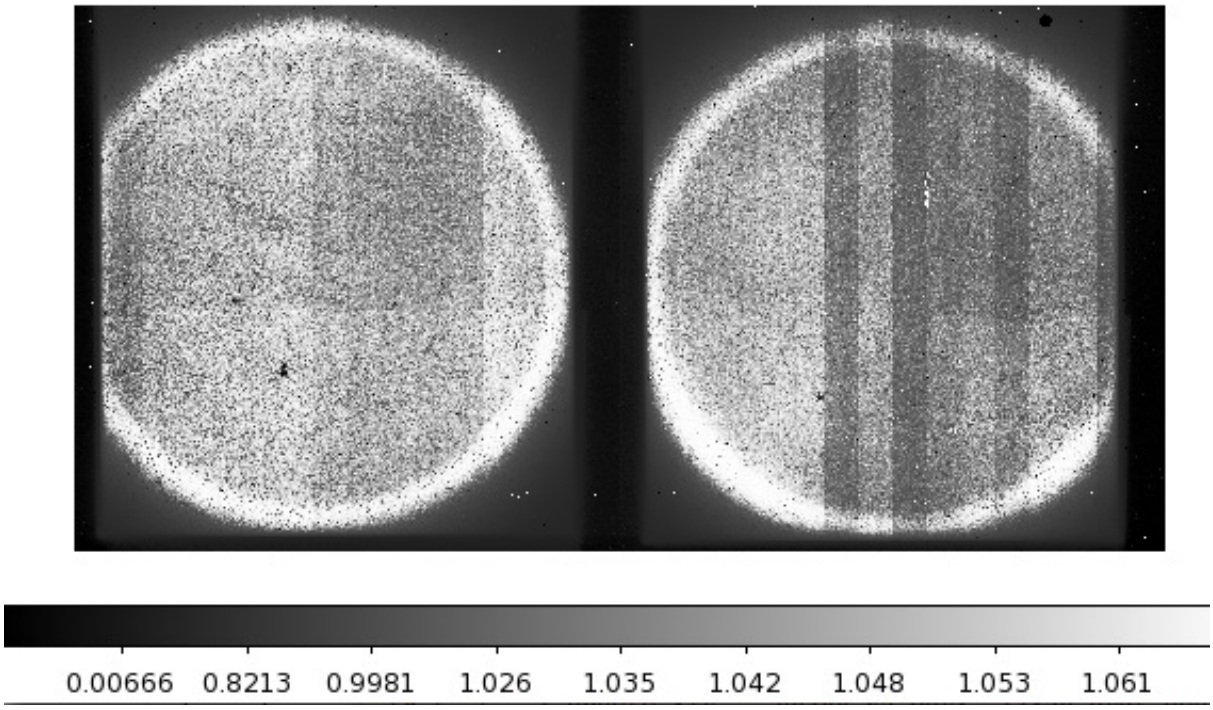


Figure 8: Flat filed of the left and right detectors.

Recipe: *ird_star_center* needs improvements in the accuracy of the computed position. Consortium is aware of this and will implement a better algorithm soon.

Recipe: ird_science_dbi run smoothly. The co-added image of the left and right detector as well as the co-addition of the difference exposures is output. In this observation the star_center algorithm worked fine. We show the result of this mode in Fig.9 in filter set up H23. The result for filter J23 appears very similar as does the results obtained for DPI modes. In classical imaging, the reduced images look again similar to the one shown in the upper panel of Fig. 9, but no differential exposures are produced (bottom of Fig.9).

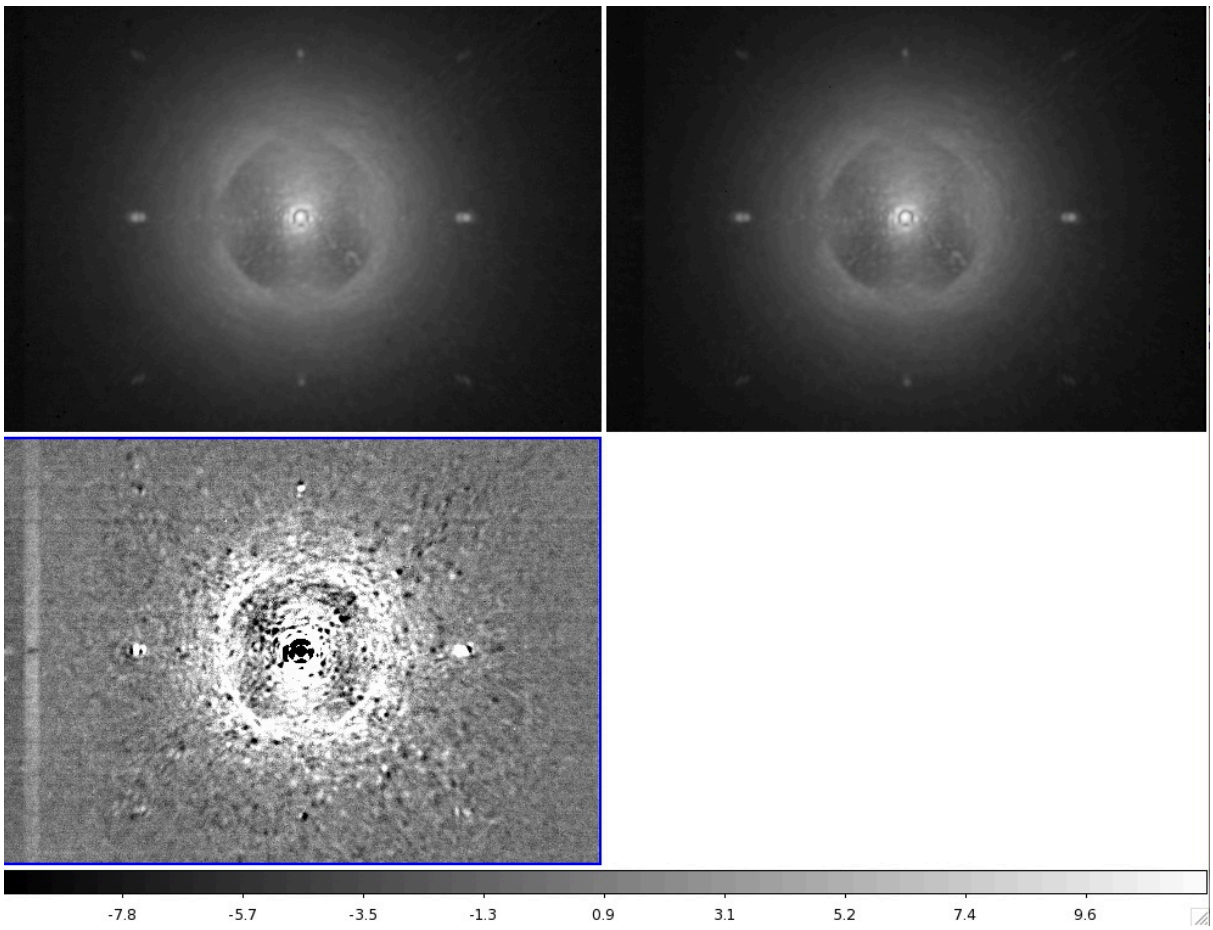


Figure 9: Typical example of final pipeline products in DBI mode. Top left the coadded image of the left detector is shown, and similar on the top right, the coadd of the right detector, and in the bottom the coadd of the difference exposures is shown. Figures obtained for different filter combinations or even in DPI mode appear very similar. Final pipeline products that are obtained in classical imaging mode are similar to that shown in the top.

Recipe: ird_science_imaging. This recipe analyse data taken with the *obs*_flux template. It is used to measure the PSF that is required for accurate flux determination of the putative companion. During the sequence the star is moved outside the coronagraph so that the full PSF can be measured. The result image looks very similar to the one seen at the RTD as displayed in Fig.3.

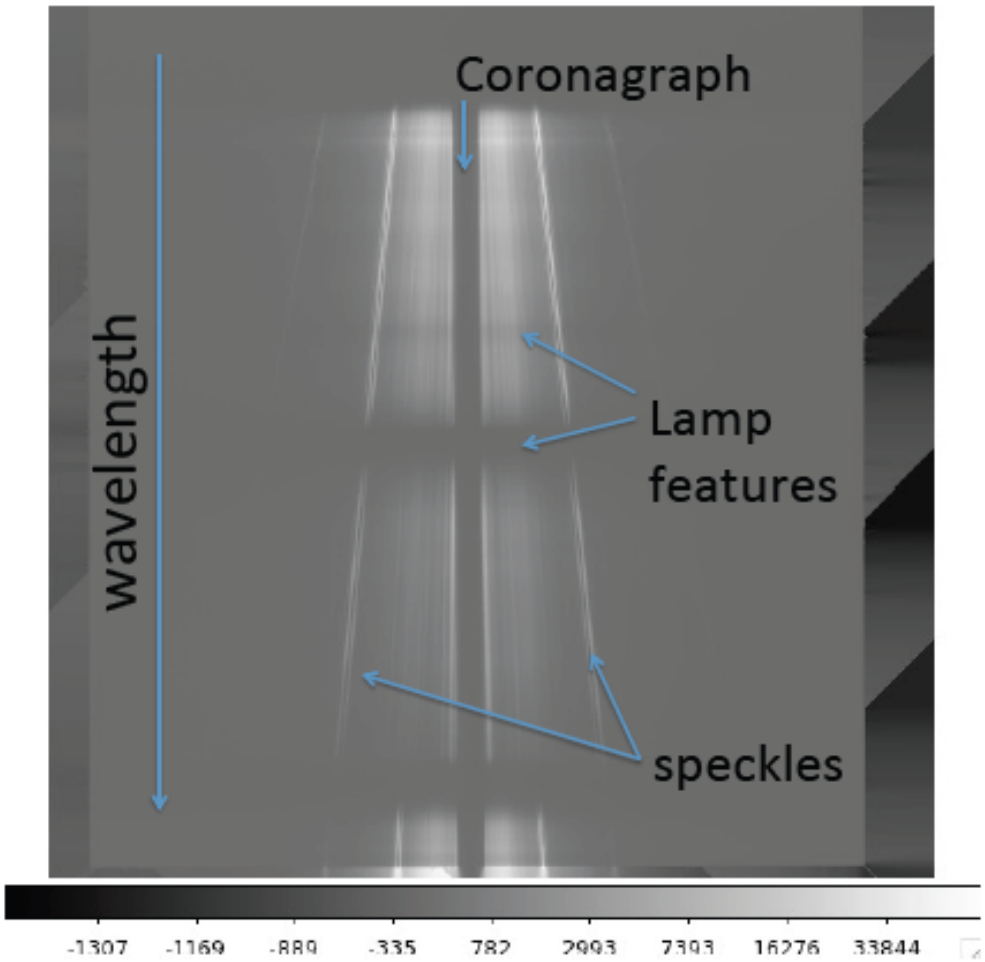


Figure 10: Coronagraphic image from the telescope point source simulator as obtained in the MRS mode.

Recipe: ird_science_spectroscopy: Analysis of the MRS and LRS data.
Results of the MRS data are shown in Fig.10 and that of the LRS mode in Fig.11. In both modes a spectrum of a point source behind a coronagraph is displayed. The point source is from the telescope simulator that shows at different wavelengths absorption features. In the image one sees the speckles. The wavelength is the vertical axis increasing from top to bottom. The horizontal axis is the wavelength dimension. In the bottom of the image the second order is seen that is not useful for science. The pipeline flawless processed the LRS and MRS data.

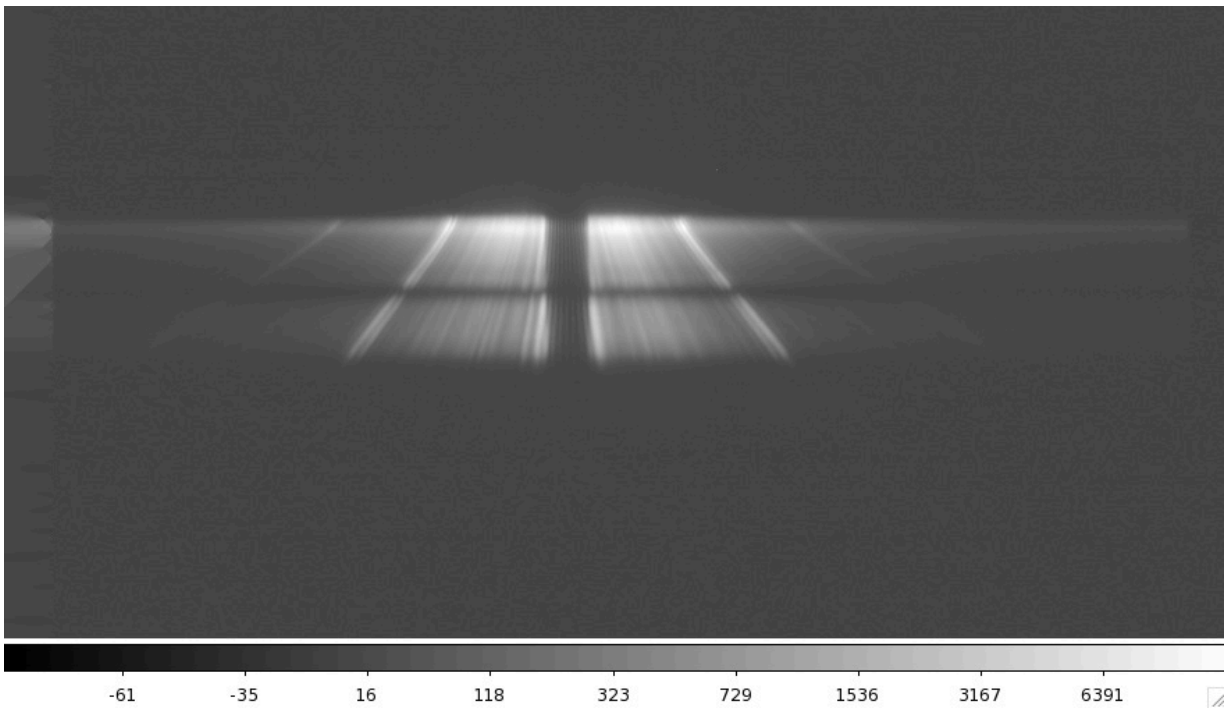


Figure 11: Same as Fig.7 for the LRS mode.

11.3 **ZIMPOL**

Bias, dark, modulation and demodulation efficiency, instrument flat, and science data of Sect.11 were analysed and pipeline products inspected.
The QC parameters are extracted from the fits headers of the pipeline products and sent to QC scientist for review. The data reduction scripts are attached to Appendix B. Detail comments to individual recipes are given below.

Recipe: bias, dark, mode efficiency, flats then sph_zpl_science_p23 science_2 (see Appendix B).

The output is a file with 8 extensions, in ext=0 we have the I image, in extension 4 the Q image. This particular test was done with the CLC (the 4QPM was also verified). We clearly see the CLC footprint (mask and holding structures). The dark hole is clearly visible, and one notices the slight misalignment of the star behind the mask (differential tilt between the calibration sources and on-sky data, to be fine tuned).

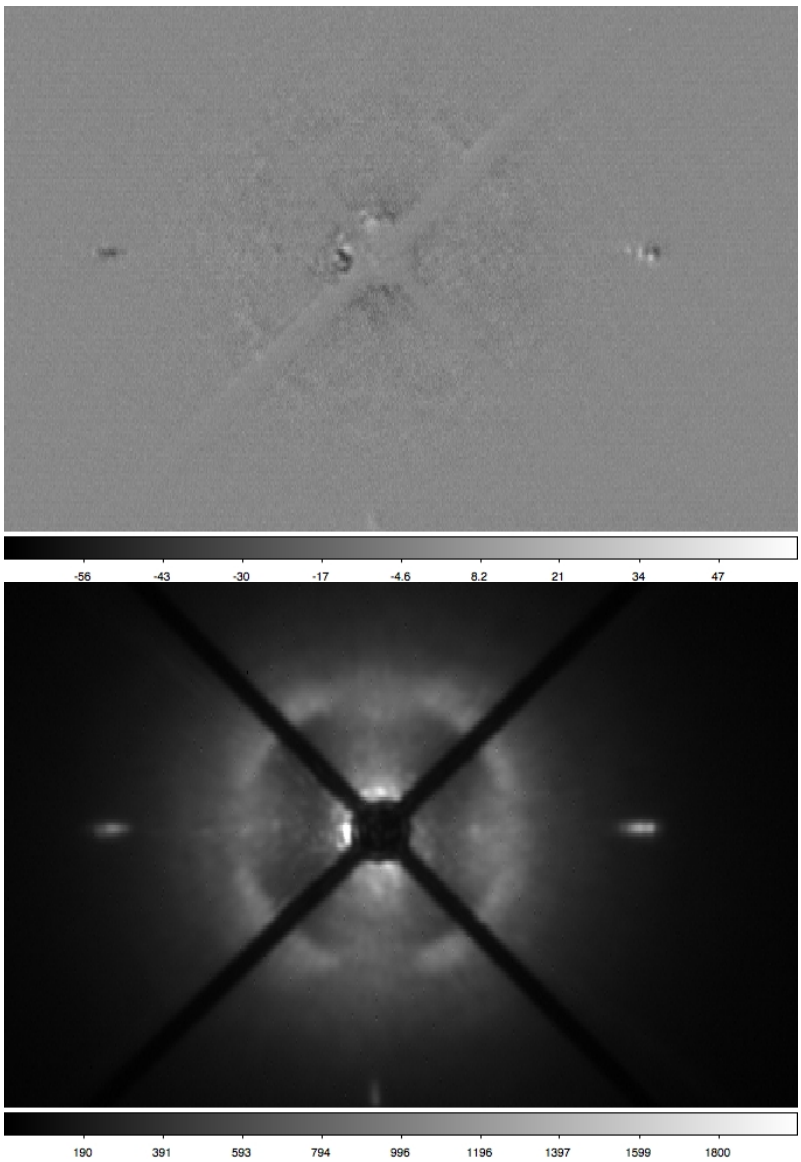


Figure 12: Results of the ZIMPOL pipeline for sph_zpl_science_p23 recipe. The top image is the Q image, while the lower image is the I image.

11.4 General status of the pipeline

At present there are 20 technical tickets and 40 performance and science relevant tickets open. The technical tickets are seen as high priority tasks as they need to be closed before a proper installation of the pipeline is possible at Paranal, e.g. without damaging the system there. We take end of January as a deadline to close those technical issues, which are for example related to: memory leaks, compiler warnings, build system, invalid fist file, etc.

The performance tickets will be prioritised in three categories which are: important for Com1, Com2, and nice to have. The com1 tickets shall be closed 6 weeks before Com1.

Nevertheless, all data taken during the PAE test verification run are flawless processed by the pipeline. One issue is identified by the wavelength calibration of the IFS data. Furthermore, we find that ZIMPOL data reduction takes, at least in environment at Grenoble, longer than the execution of the data taking (OB). We understand this feature being due to the network file system set-up combined with lot of disk I/O by the ZIMPOL recipe. This needs to be verified in the Paranal environment.

12 SPHERE main performance indicators at PAE

12.1 CPI performance

The performance of the CPI is easily seen through raw contrast levels common to all subsystems. An excellent indicator that SPHERE has achieved a technological breakthrough is when comparing its raw detection capabilities with current generation instrument capabilities. The detection limits currently reached are the product of optimized observing strategies such as angular differential imaging (ADI) followed by heavy post-processing using optimal frame combinations (LOCI, PCA). Two emblematic systems can be used for comparison purposes, namely β Pictoris and HR8799.

The two images below represents snapshots taken during the PAE tests with IRDIS, using the turbulence generator (0”.85 seeing and 12 m/s wind speed), in the high flux regime, representative of both simulated targets. We used the DRH to clean up the frame, and performed a high-pass filter to remove the AO residual halo (mostly the artificial cloud effect), but NO other post-treatment was applied (no DBI).

We injected fake planets at the right contrast and separations in the raw data to simulate our two favourite and representative targets. The result speaks for itself, all simulated companions are detected on the RAW SPHERE images, which undoubtedly demonstrate the technological gap with current generation instrument, and bode well for the future of this instrument.

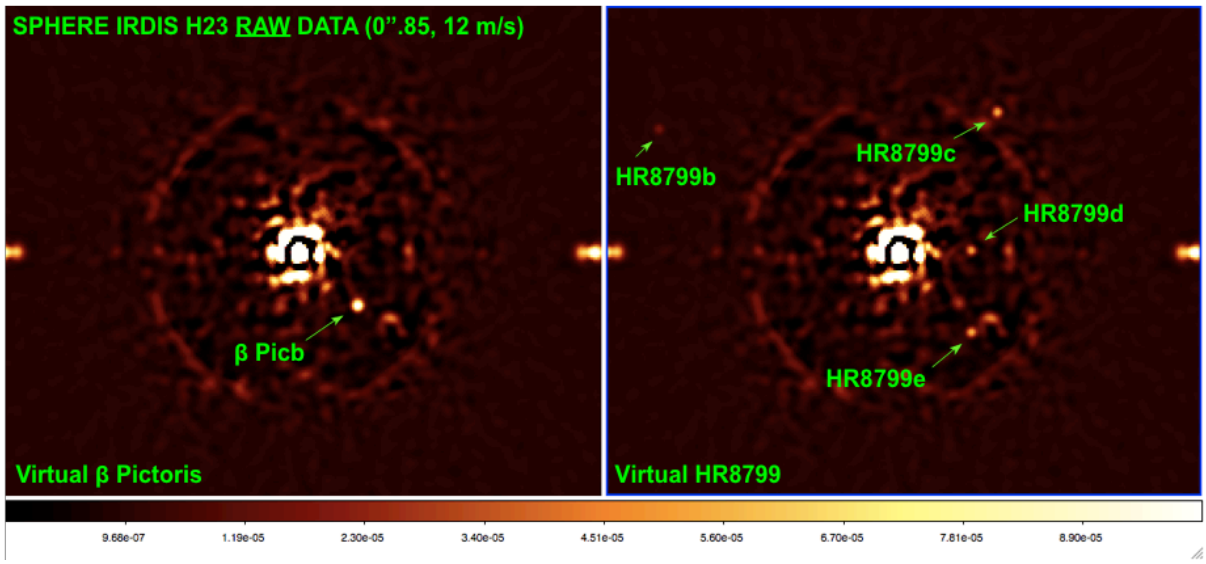


Figure 13: SPHERE PAE raw contrast demonstration for CPI under turbulent conditions using IRDIS. The fake β Picb is clearly detected, while all four HR8799's planets are also clearly seen. Several speckles show at the same level, and are believed to be due to dust particles on the coronagraphic mask. These speckles are expected on RAW images, and should disappear after the first stages of high contrast post-treatments (SDI, PDI and/or ADI). Note that it was also noted that coronagraphic flat fields should prevent the formation of these speckles in the first place, and will be considered for implementation.

12.2 **IRDIS DBI contrast**

IRDIS DBI contrast is presented in the figures below. Figure 14 shows qualitatively the contrast performance of SPHERE in the H-band, before and after SDI (ADI is not accounted for because of the difficulty to simulate it in the lab).

The SDI performance is a factor of ~2 above the spec (spec: 5e-6 at 0".5, 5σ). The loss is attributed to the dead actuators, and the nominal performance should be restored with the new Lyot stops currently being manufactured.

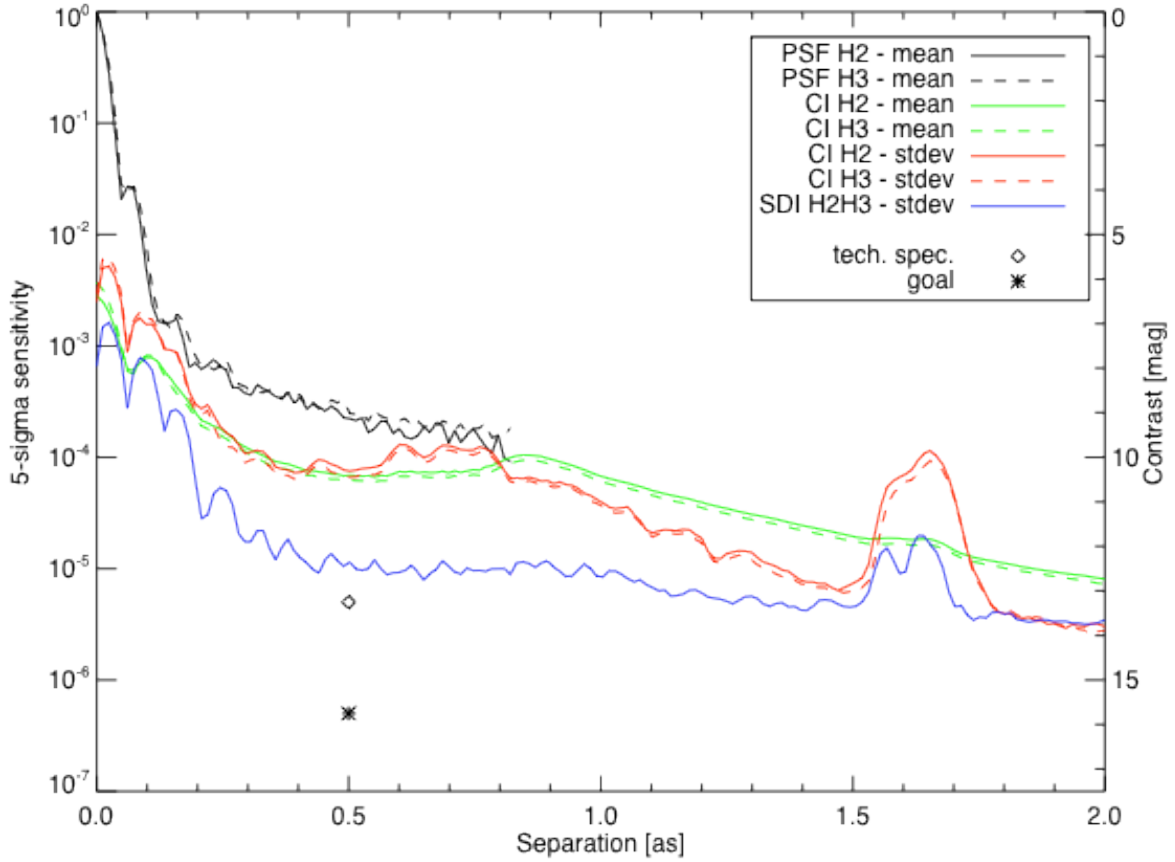


Figure 14: IRDIS H23 contrast curve (5σ) produced with the data taken during the PAE tests.

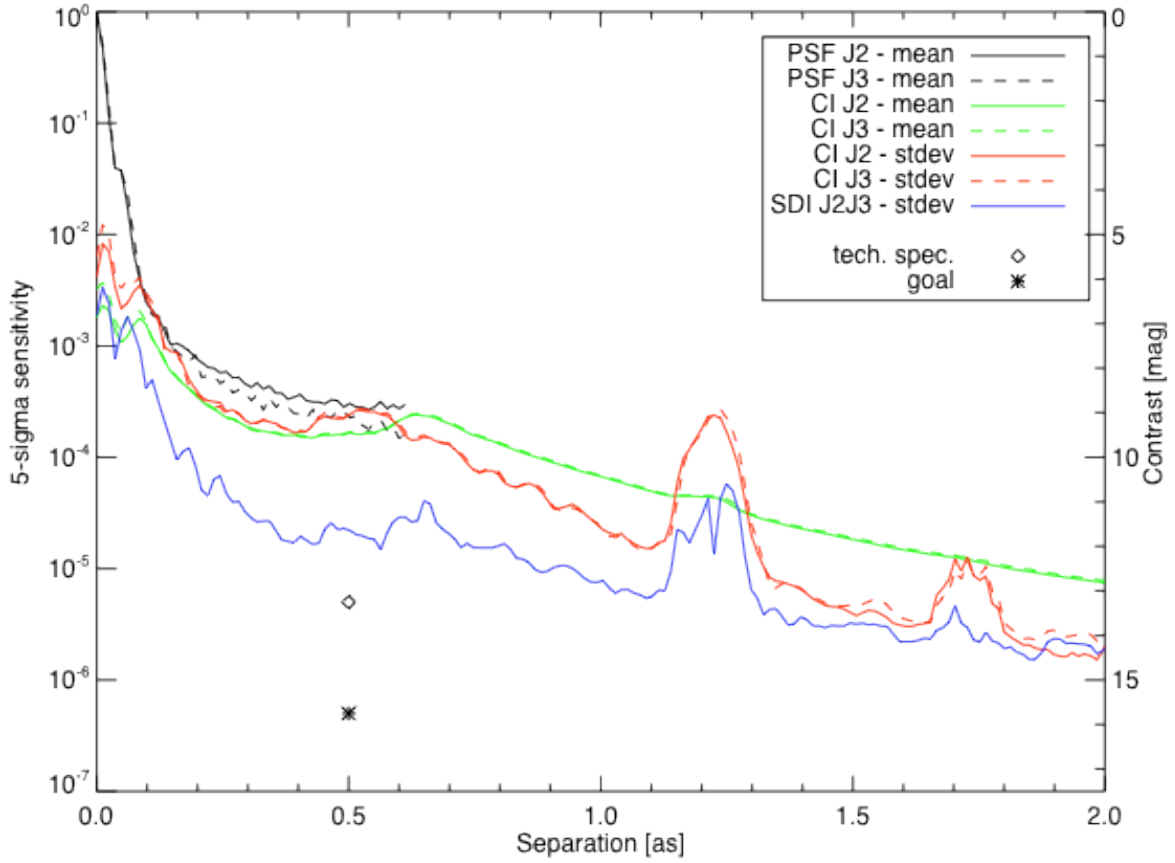


Figure 15: IRDIS J23 contrast curve (5σ) produced with the data taken during the PAE tests.

12.3 **IFS raw contrast and spectral deconvolution**

There are only 2 modes for the IFS (IFS-YJ, and IFS-H). Spectral deconvolution was applied to both data sets (obtained during the PAE tests), yielding good results very slightly better than IRDIS's SDI and close to the specs (see Figures below).

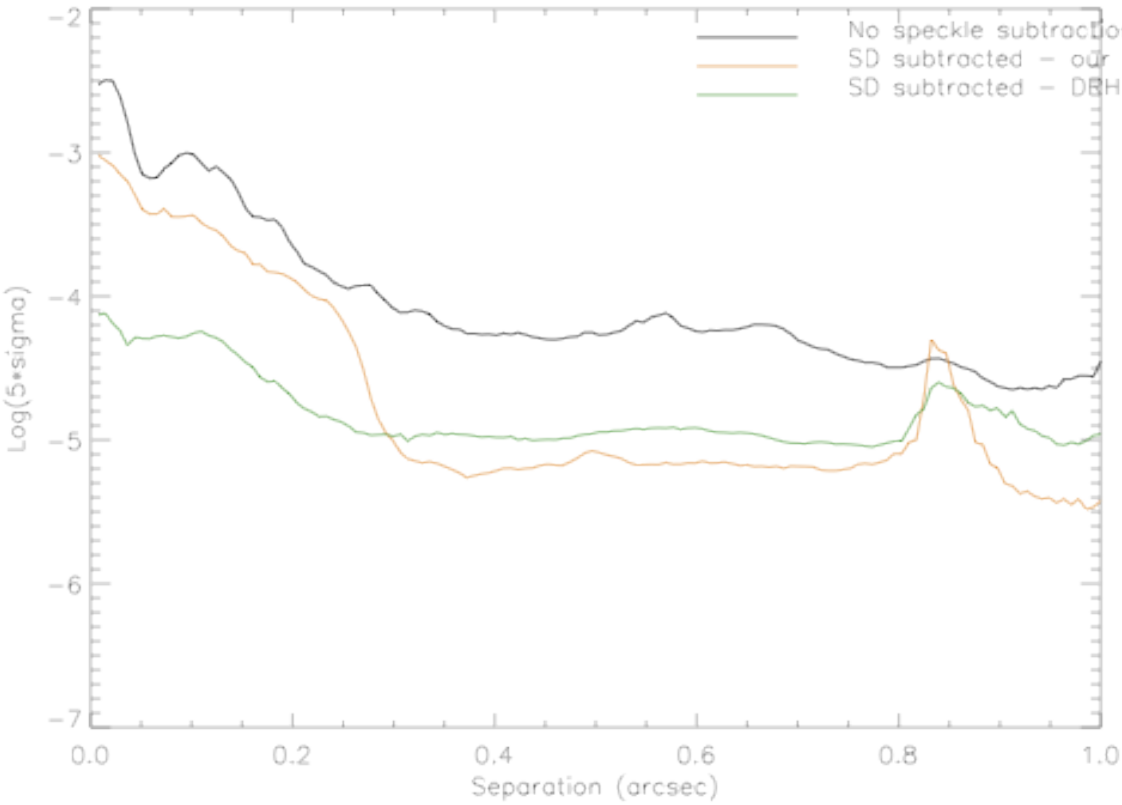


Figure 16: IFS YJ contrast performance (5σ), comparing the DRH and IDL spectral deconvolution pipeline.

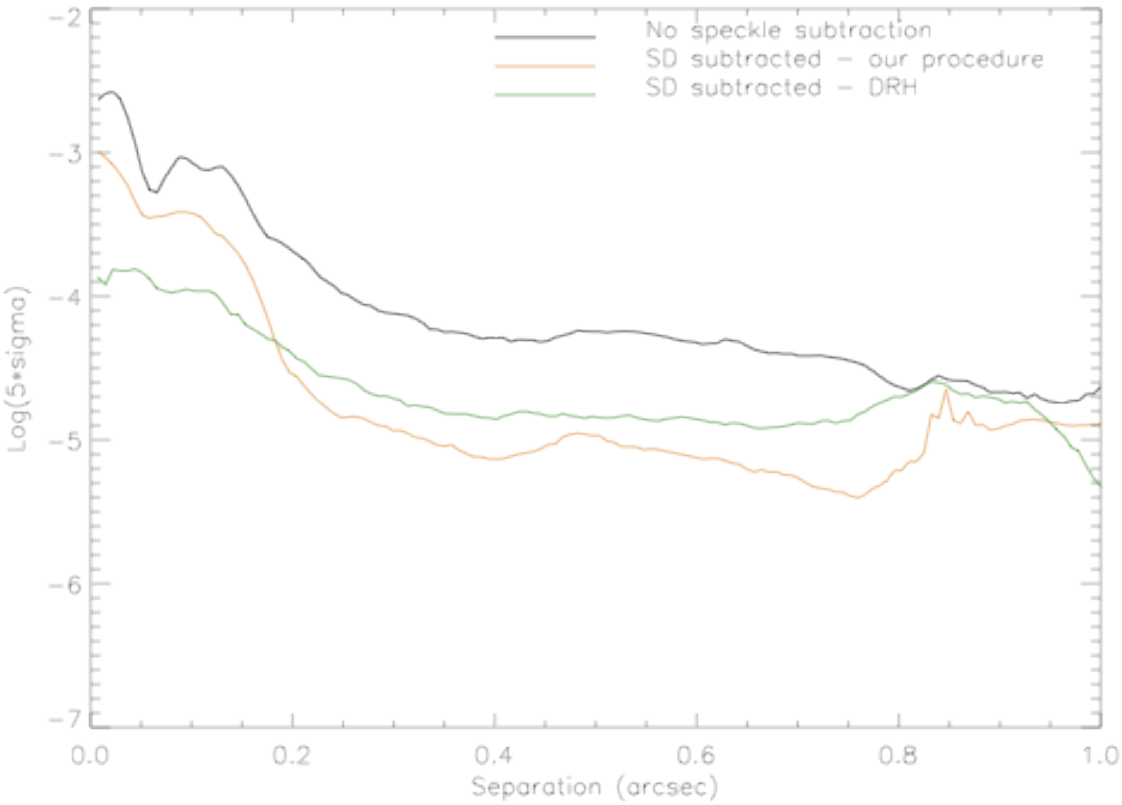


Figure 17: IFS-H contrast performance (5σ), before and after spectral deconvolution.

12.4 **ZIMPOL fast pol contrast**

Zimpol fastpol data was used to produce contrast curves as shown below. The gain between the raw coronagraphic contrast and the polarimetric contrast is impressive (~100) even though a factor of 10 above the specs. The discrepancy is attributed to a beam shift currently under investigation.

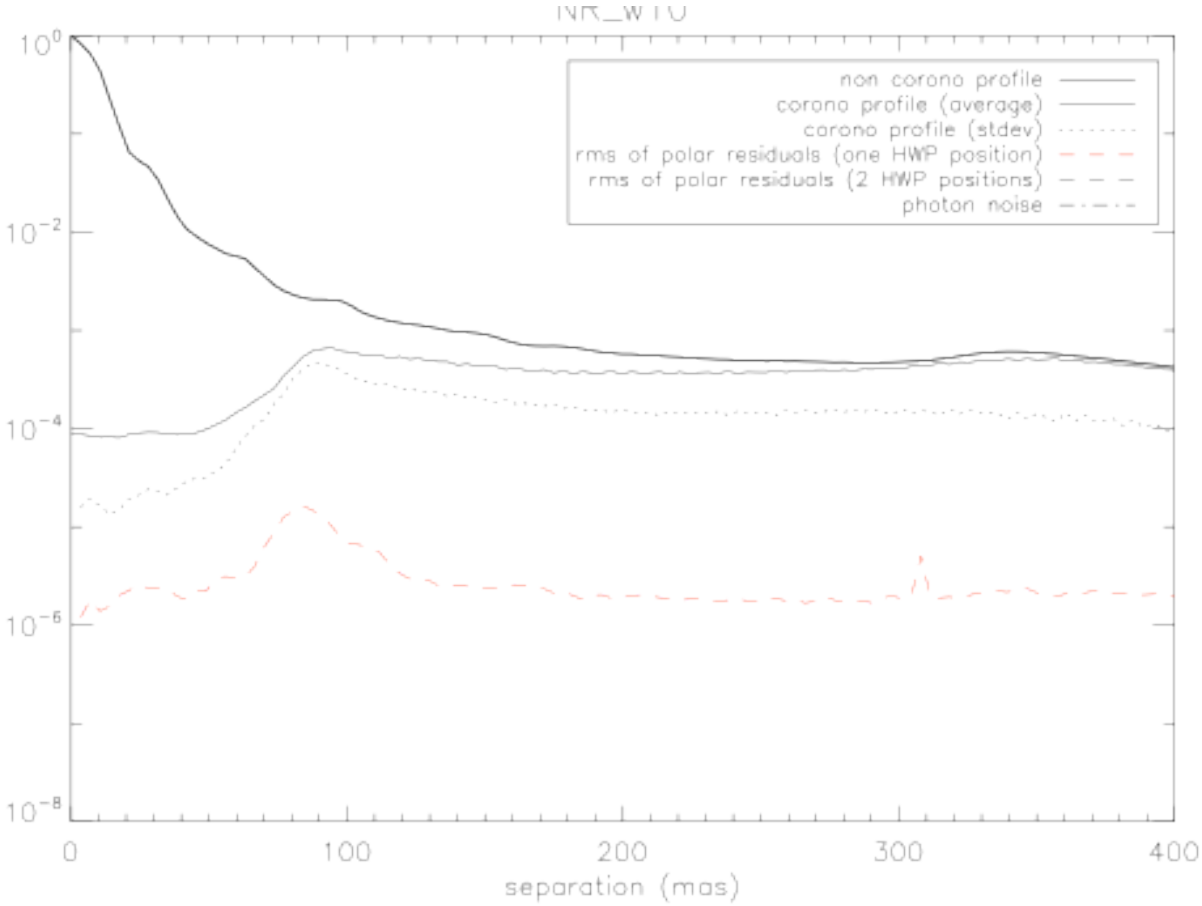


Figure 18: ZIMPOL fastpol contrast (1σ).

13 SAXO specific tests (Oct 29-31)

13.1 Pending tickets, discussion with SAXO and INS

The PAE requires a conclusion for all pending SAXO tickets. There will be a discussion with SAXO and INS on the items below:

SAXO configuration problems impacting performance/computation correctness:

SPHERE-68: Possible problem in DTT and PTT reconstruction problem
Presence of the problem in the system verified; correct configuration templates not implemented.

AI1 INS: modification to matrix optimizer template, SAXO engineering panel modification for this sign.

SPARTA RTC functionality pending configuration/testing on SAXO side:

SPHERE-65: List of OLDB and CDMS RTC keywords to be collected at the end of the exposure unpopulated
The SAXO team reported that the list of keywords has been discussed inside the consortium; however, the SW remains unconfigured in this respect.

AI2: INS to implement proposal by SAXO.

SPHERE-83: SAXO HO interaction matrix unscrambling
Long standing issue: functionality delivered in 2011 but never tested. Will it still get into the final system? Suggest that functionality is quickly verified at IPAG. Rescrambling do be done on Paranal.

SPHERE-51: Verification/re-configuration of SAXO HODM actuator and VisWFS sub-aperture maps in Display Servers
Qualified as not critical for the SAXO Team. Should it be closed and the current WFS/DM orientations maintained as final?

Closed, to be replaced by SPHERE-83
AI3: JFS/SAXO to generate new and correct ordering vector.

SPHERE-59: Single data replication service to be maintained at IPAG in machine 'wsrdata'

SPARTA recorded data replication service, which will be the standard in Paranal, not enabled at IPAG. Has been tested in Garching and quickly at IPAG. Suggest to enable on Paranal only

AI: GZi to close it?

Modifications to be implemented in the SAXO system for enhanced reliability, not requiring a new SPARTA SW delivery:

SPHERE-81: SAXO RTC concentrator machine to be migrated from RAID0 to RAID5
Already performed in the AOF systems. Failing to do so will cause down-time in the of disk failure during commissioning. Must be done locally at IPAG, takes 1-2 hours.

AI: ABa to do it on next INS installation

SPHERE-30: Fast system recovery after loop-opening during an observation
Suggested by the SPARTA Team as a result of a related SPR issued by the SAXO Team; never acknowledged/rejected. Suggest that ESO issues use case and SPHERE INS implements recovery from loop failures in templates (cf. INS PAE comment from Claudio, no alarm propagation from SPARTA SW to INS)

Idea was for convenient operation during AIV.

PAO requirement: Pop-up in case of loop opening (Decide to abort or reclose), so use-case to be issued by SPARTA (MSu), implementation by INS (AI).
AI4: INS/ABA to clarify the need with SPHERE and PAO.

Modification for proper archival of IM calibrations

SPHERE-32: Synchronisation of RTC configuration between CDMS runtime and $INS_ROOT/RTCDATA contents and later archival
Related to the calibration + archival

Template saveCLmatrices exists to transfer RTC configuration to INS_ROOT.

History possibly through SVN.

AI5/6: SPHERE/PAO to sort out issues and make archive available.

SPHERE-76: Inconsistency of the closed-loop matrices optimisation results archived in some recent SAXO configurations
Related to the calibration + archival. Suggest to close
Close 76.

SPHERE-77: Operation performed by the "Copy" option in SAXO expert panel to be modified
Related to SPHERE-32. Suggested to remove panel and move matrices from CDMS to INS_ROOT via template, close ticket
Close 77. AI7: GZI to remove copy button
SPHERE_gen_tec_save_clmatrices

SPHERE-79: No easy means of testing a newly computed set of control matrices in SPHERE without updating $INS_ROOT
Related to the calibration + archival.

Currently, SPHERE SW performs a number of steps manually to calibrate SAXO. The final IM calibration process should be carried out by a single template. The suggested sequence involving and resolving the pending tickets 32,77,79 above is:
Optional: Set dead actuator map and number of controlled modes. This is required in case of new dead actuators.
A re-definition of the dynamic slaving map is not required (tbd), impact of new dead actuator if it is a) a master (change of weighting map required?) or b) a slave (IFs for K-L comp?).
Record IM (new IM for the given mode in CDMS)
Pop-up: Update K-L basis (Y/N)? 'Y' takes an hour or so.
CL matrix optimization (set of new matrices in CDMS)
RTD of IM. Pop-up: Save to INS_ROOT (Y/N)? - (SPHERE-32)
Optional: Check-AO (Quality crit tbd, IRDIS image display? SPHERE-79)
Pop-up: Save to SVN (Y/N)? - (how? VLTSW-9732)

Modifications to be implemented in the SAXO system for enhanced problem diagnosing, requiring a new SPARTA SW delivery:

SPHERE-80: SAXO RTC bootscripts upgrade/enhancement
Already implemented in the SAXO SW trunk; no risk.

80-closed, JSa: already installed, files in system.

IDL-based procedures required for instrument maintenance at Paranal
Some SPHERE configuration maps (e.g. projections for mirror to Zernike modes (AI SPH-TRR-465), excitation signals for calibration) are not computed but the instrument SW itself but are an input manually created at a certain point in time using IDL routines. These maps are supposed to evolve only if the HW physically evolves (e.g. deformable mirror ageing) or a subsystem is replaced (e.g. WFS camera replacement). Other IDL routines may exist which are a useful aid for maintenance operations.

SPHERE has identified and gathered together these routines and is in the process of commenting them. In addition, as IDL is not a Paranal-supported tool, they the purpose and usage of these routines should be described.

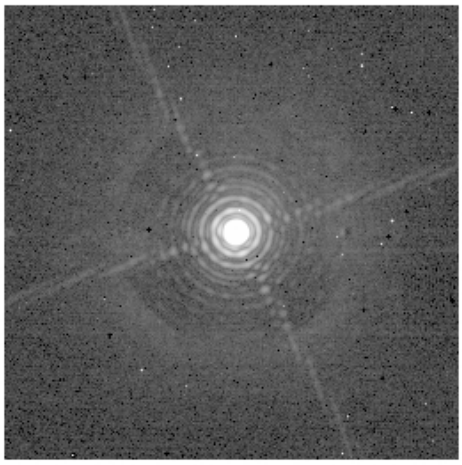
AI 8: Provide list and routines with PAE package, discuss with engineers which ones absolutely need to be a template and which ones can remain IDL (or Matlab).

13.2 SAXO calibration

Templates
SPHERE_gen_cal_imatrix.tsfx
SPHERE_gen_cal_optimize_clmatrices.tsfx

A. Go through current process of IM calibration. Close loop with TSIM.

B. Repeat A w/o re-computation of K-L basis.
SPHERE_GEN_IRDIS302_0109 for PSF



Skipping the K-L computation does not noticeably affect the closed loop performance.

C. Add new dead actuator, modify number of modes (950!). Repeat step A.
Procedure in CPI maintenance manual (doc 675) needs to be updated (cal IMs at the very beginning, check for dead/slave conflict, modify number of control modes). **AI9: JSa to update dead actuator procedure**
- Nmodes needs to be set manually in three different positions. Possible to make this transparent (automatic) to the user?

- For an H=0 star (TSIM), the DTTS2 is chosen but saturated.
AI10 JFS: Update flux table (see later action on re-calibration of lookup tables for modes vs flux and seeing)

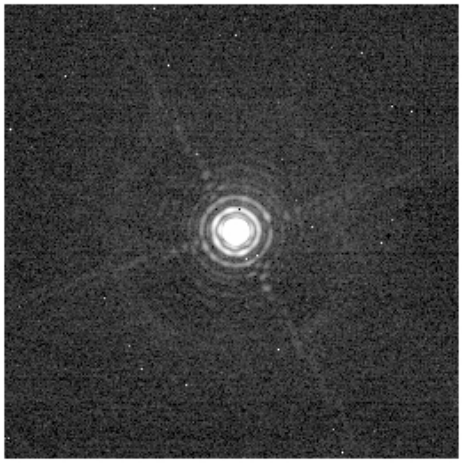


Image: SPHERE_GEN_IRDIS303_0001
BG: SPHERE_GEN_IRDIS303_0002

Adding a dead actuator and reducing the number of corrected modes by 49 to 950 works smoothly and does not noticeably affect the closed loop performance.

SPHERE_gen_tec_calpreset.tsfx
SPHERE_gen_cal_dtts_backgnd.tsfx

Lower row bias of DTTS image is fluctuating in time. Impact may be removed by setting flatfield map of bottom row to Zero.

AI11 JFS: Verify whether switch from COG to WCOG for DTTS when moving from internal source to TSIM/sky may be responsible for the shift in spot position observed between star center and coro observation. If yes, modify DTTS FF to not use bad bottom row.

SPHERE_gen_cal_wsfw_refslopes_nir

Data in /insroot/SPHERE/SYSTEM/COMMON/RTCFILES/REFSLP/MIRR/FP2_VWFS_VADC0_WSFW_1.fits, FP2_VWFS_VADC0_WSFW_2.fits
WFS over-illumination! Reason: Lightsource was set to green laser (532 nm) when FP2 source was moved in -> too much light.

AI12 JSa/INS: Modify template. Set lightsource first, then move it in.

SPHERE_gen_cal_dtts_gain.tsfx

Flatfield for DTTS. Ok, no comments

SPHERE_gen_cal_imatrix_dtt.tsfx
SPHERE_gen_cal_imatrix_ittm.tsfx

done, no problem

SPHERE_gen_cal_vwfs_backgnd.tsfx
ok, BG level is fluctuating (level of the central octants in the center below zero is unknown)

AI MKa: check with MDo, define action. Closed, ticket issued (VLTSW-10327)

SPHERE_gen_cal_voffset_ir

ok, 19C measured on HODM

/insroot/SPHERE/SYSTEM/COMMON/RTCFILES/VisHOCtr.ACT_POS_REF_MAP_PAE20131029.fits

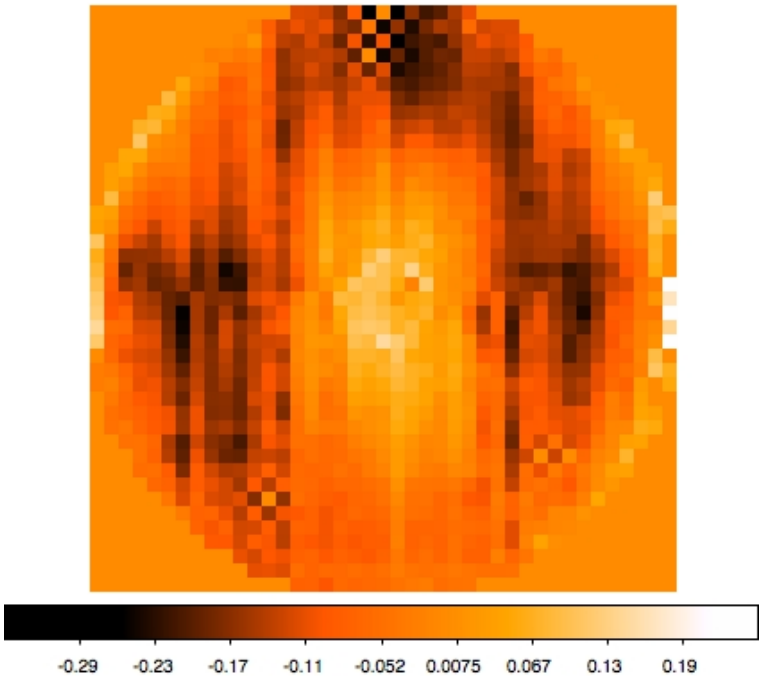


Figure 19. HODM offset voltages for an ambient temperature of 19C. Normalized actuator voltages are between -0.35 and 0.25.

SPHERE_gen_tec_code_health_check.tsfx

Ok. Template does not yet use the replay function of the voltage.

Voltage replay may cause some problems with template strategy.

AI MKa: check with MSU/ABA for the status. Done, technical pb resolved, implementation in template pending...

SPHERE_gen_cal_imatrix_pms.tsfx
SPHERE_gen_cal_pms_refslopes.tsfx

Ok, no comments.

13.3 **NCPA**

SPHERE_gen_cal_nir_ncpa_ent2det.tsfx

IRDIS PSF image after NCPA calibration
SPHERE_GEN_IRDIS302_0107 (star pos 482,538)
SPHERE_GEN_IRDIS302_0108 (star pos 482,538): BG
RefSlopes after NCPA calibration:
/insroot/SPHERE/SYSTEM/COMMON/RTCFILES/REFSLP/FP2_IRDIS_APO_ADC0_IDFLT1

The template runs through. The first iteration improves the PSF, but further iterations degrade it. Hence, the process is unstable.

The figures below show the reference slopes before and after NCPA calibration. Figure 22 shows that NCPA introduces low spatial frequency aberrations which improve the PSF, but also a high spatial frequency component mostly visible at the aperture edges which may be the cause for the non-converging process.

The SPHERE internal H-band Strehl ratio after one iteration is 94%. This value is not corrected for source extension, so represents a lower limit.

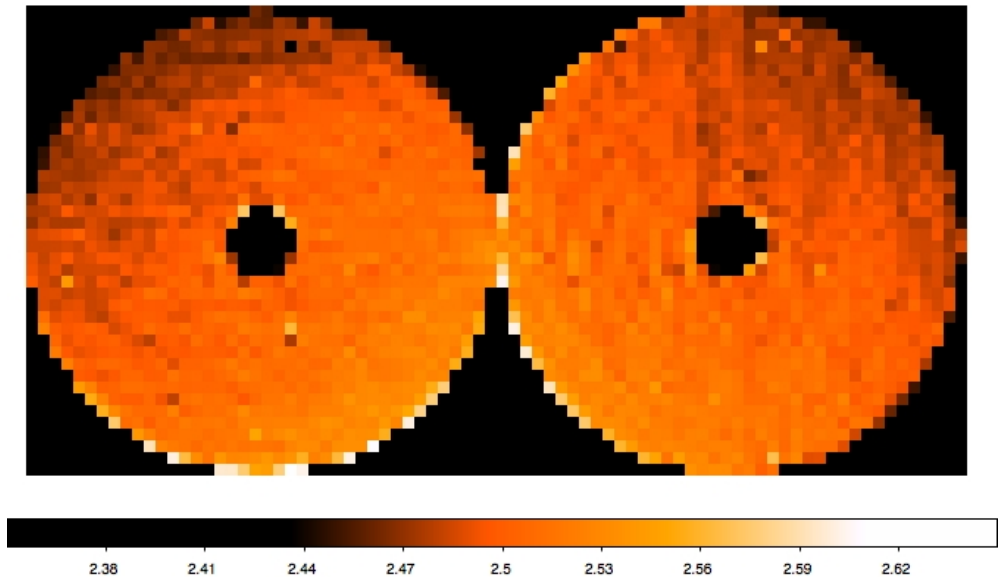


Figure 20. Reference slopes (Left: X, Right: Y) without NCPA compensation

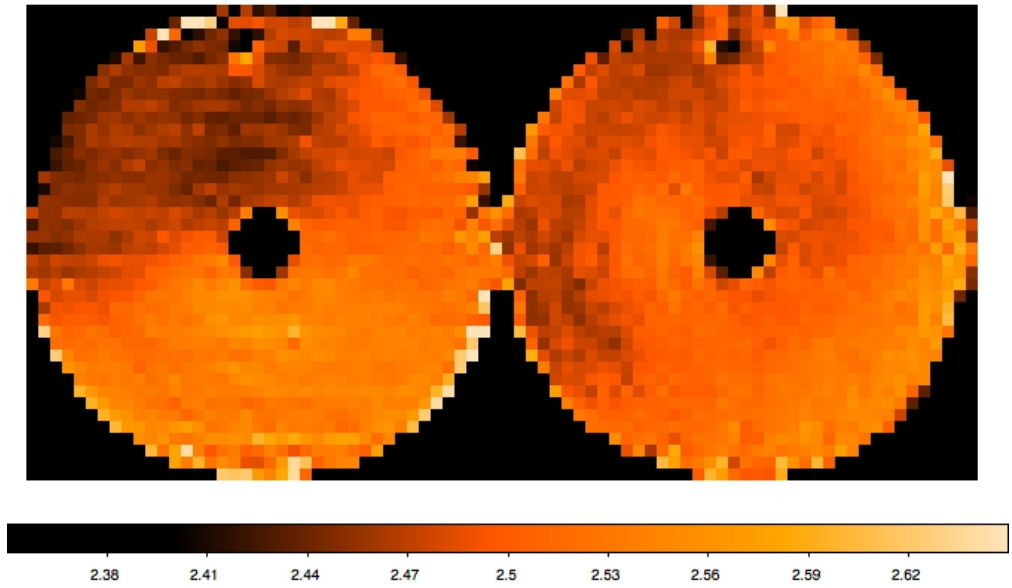


Figure 21. Reference slopes (Left: X, Right: Y) after one NCPA compensation iteration.

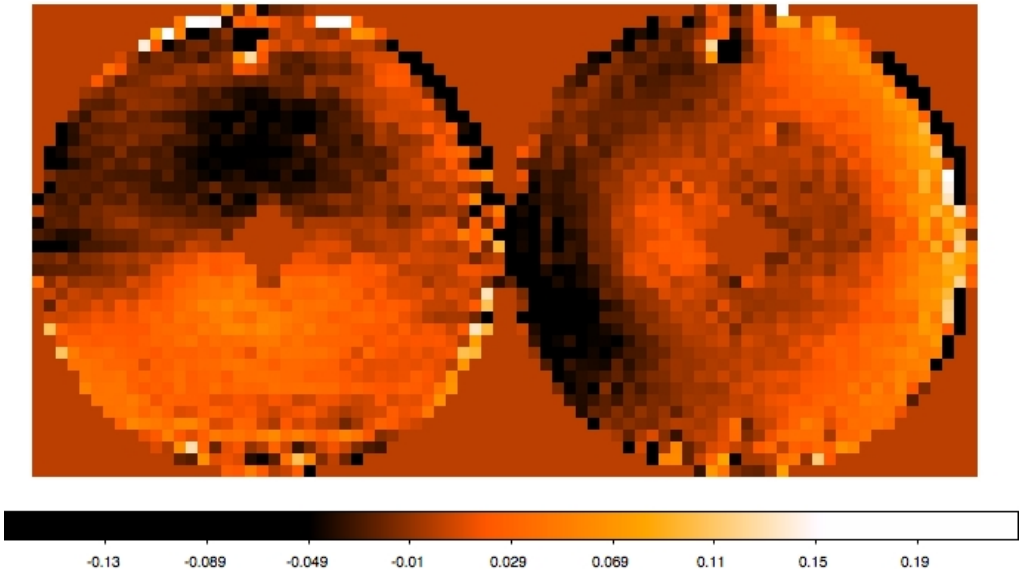


Figure 22. Delta slopes introduced by NCPA (difference between the two figures above).

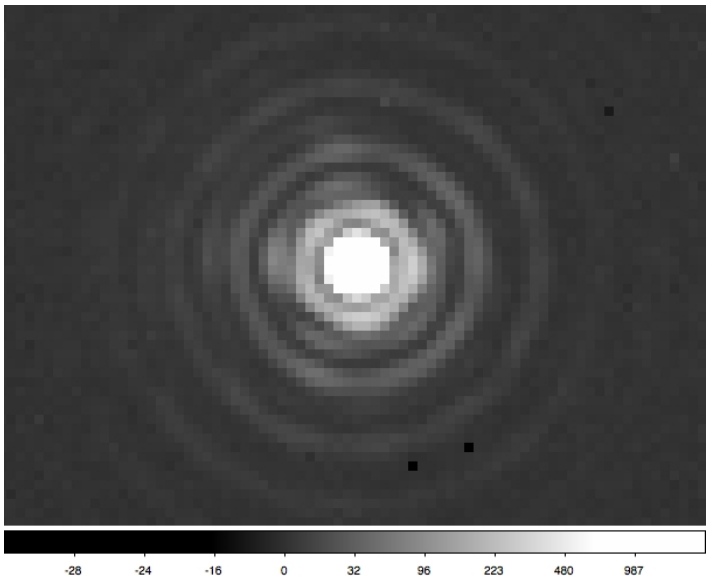


Figure 23. H-band PSF with 94% Strehl after one NCPA iteration.

Figure 24 shows the small difference between LP_475 and LP_780 reference slopes of 0.004 px rms. Assuming spatially uncorrelated noise, this corresponds to just 0.3 nm rms WFE.

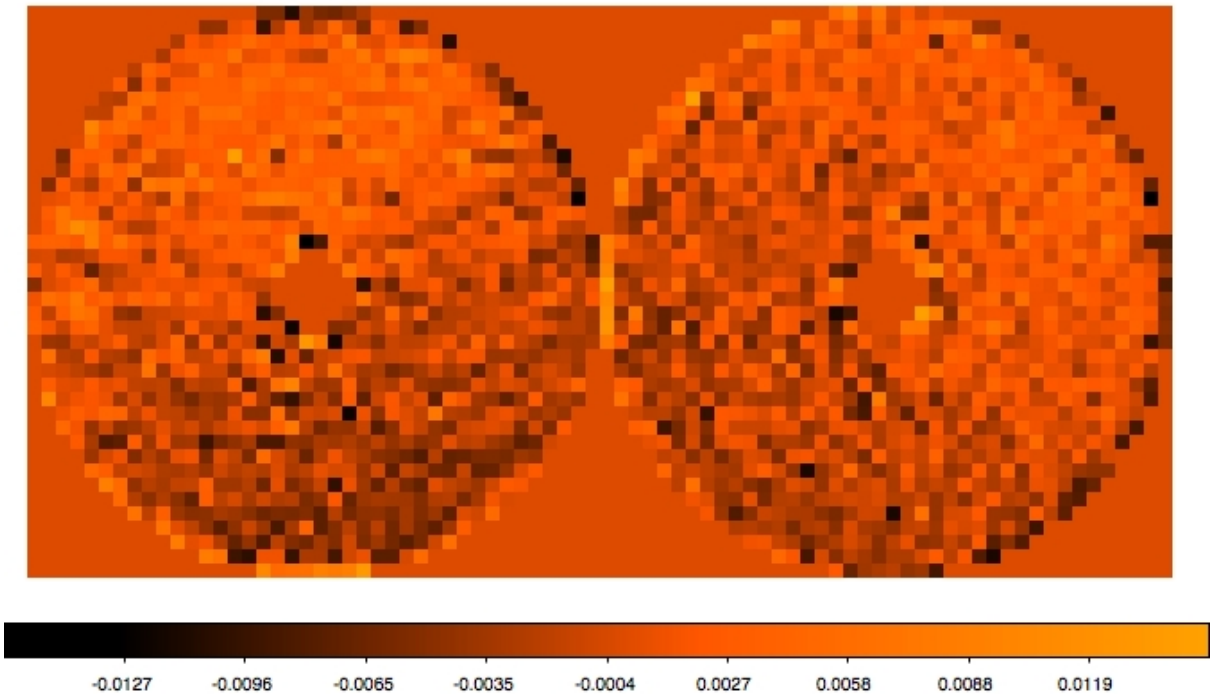


Figure 24. Reference slopes without NCPA correction difference between LP_475 and LP_780 WFS filter.

SPHERE_gen_cal_vis_final_slopes.tsfx
SPHERE_gen_cal_vis_ncpa_ent2det.tsfx
SPHERE_gen_cal_voffset_vis.tsfx

Templates run through and improver SR by ~20% relative at ~600nm wavelength.

SPHERE_GEN_ZIMPOL303_0001: image after NCPA calibration
zimpol_ql_beforNCPA.fits, zimpol_ql_afterNCPA.fits

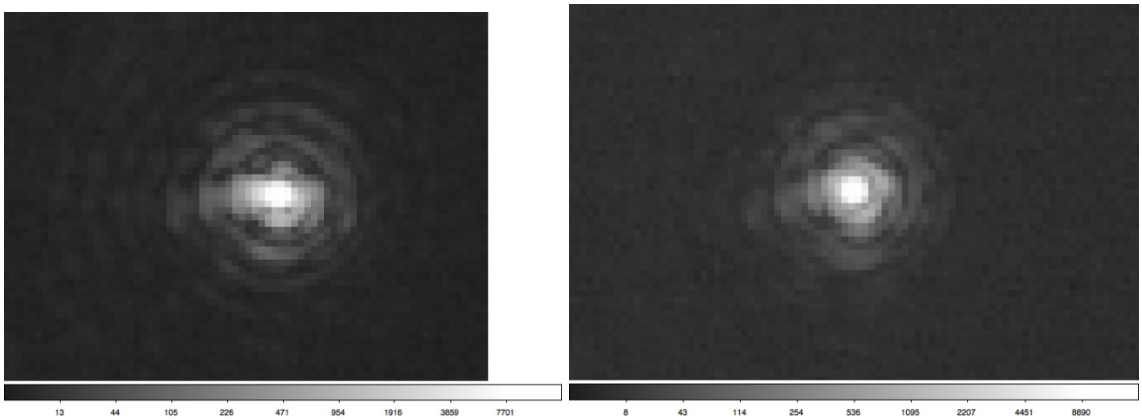


Figure 25. ZIMPOL PSFs before (left) and after (right) NCPA compensation.

Similar to the IR NCPA, the image quality deteriorates after the first iteration.

Conclusion NCPA

The excellent Strehl ratios brought by NCPA presented in the SAXO executive summary (doc 0650, issue 3) could not be reproduced during the PAE tests. The technical specification (see below) has not been met, possibly because of errors introduced by the new dead HODM actuators. Masking dead actuators in the Lyot plane (**AI22 KDO**) and improving the NCPA algorithm to work on coronagraphic images is one major area of potential performance improvement for SPHERE.

AI13 JFS/SAXO: Investigate the origin of the reduced performance and report.

TS 3.3.3: The RMS WFE at 1.6 μm of the wavefront incident upon the coronagraph during operation of the
AO system shall not be greater than
A. 15nm for low-frequency aberrations
B. 20nm for mid-frequency aberrations

13.4 **AO dynamic performance**

SPHERE_gen_tec_checkao.tsfx.
Does not yet replay voltages for turbulence simulation. Does not provide a performance criterion (e.g. Strehl ratio estimation).
AI14 JFS to specify, ABA to implement

Tests consists of acquiring stars of different brightness from very bright (mag limit of cal sources and SAXO?) to R~9 and R~15. Check automatic setting of SF, L3gain and WFS filters.

	R=2 (bright, 3.6e6 ADU/frame/apert)	**R=10 (3.5e6 ADU/frame/aperture)**	**R=15 (1.6e5 ADU/frame/aperture)**
0.85", 12m/s	Config; MEDIUM SF, gain1, 1200Hz, LP780 Data: SPHERE_GEN_IRDIS303_0003 (image) SPHERE_GEN_IRDIS303_0004 (background) Strehl (1.589mu): 84.4% (SPARTA 89.4%)	Config; MEDIUM SF, gain1000, 1200Hz, open Data: SPHERE_GEN_IRDIS303_0006 (image) Strehl (1.589mu): 83% (SPARTA 81.4%)	Config; LARGE SF, gain1000, 300Hz, open Data: SPHERE_GEN_IRDIS303_0008 (image) Strehl (1.589mu): 22% (SPARTA 63%) !! Lyot ST_ALC was used by mistake but not considered by Strehlomat1 without Lyot stop in IRDIS SPHERE_GEN_IRDIS303_0017

			Strehl (1.589mu): 24%
1.12", 12m/s		Config; MEDIUM SF, gain1000, 1200Hz, open Data: SPHERE_GEN_IRDIS303_0012 (image) Strehl (1.589mu): 75% (SPARTA 76%)	Config; LARGE SF, gain1000, 300Hz, open Data: SPHERE_GEN_IRDIS303_0009/10/11 (image) Strehl (1.589mu): 9% (SPARTA 60%), 3.6% with MEDIUM !! Lyot ST_ALC was used by mistake but not considered by Strehlomat1 without Lyot stop in IRDIS SPHERE_GEN_IRDIS303_0014 Strehl (1.589mu): 4% (MEDIUM SF) SPHERE_GEN_IRDIS303_0015 Strehl (1.589mu): 11% (LARGE SF)
0.85", 30m/s	Config; MEDIUM SF, gain1, 1200Hz, LP780 Data: SPHERE_GEN_IRDIS303_0005 (image) Strehl: 79.4% (SPARTA 69.4%)	Config; MEDIUM SF, gain1000, 1200Hz, open Data: SPHERE_GEN_IRDIS303_0007 (image) Strehl (1.589mu): 75% (SPARTA 54%)	still stable
1.12", 30m/s		Config: Medium SF, Gain 1000, 1200Hz, open Data; SPHERE_GEN_IRDIS303_0013 (image) Strehl (1.589mu): 63% (SPARTA 53%)	

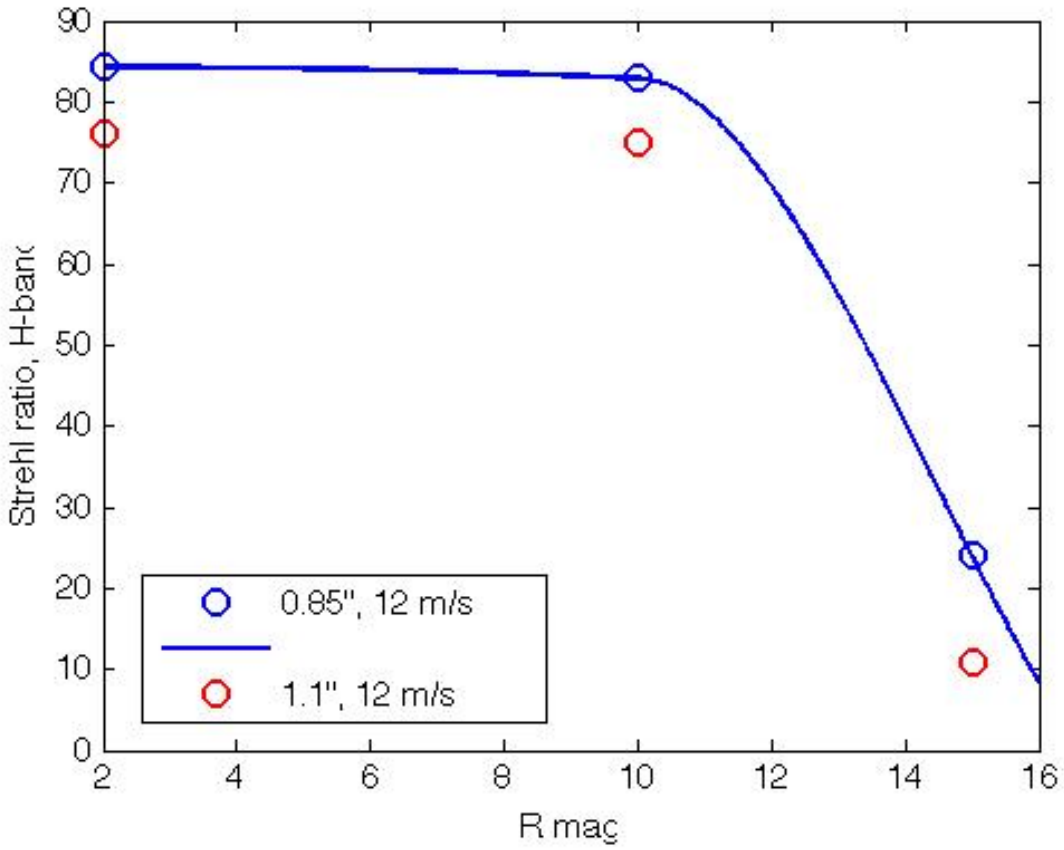


Figure 26. H-band Strehl ratios measured as a function of guide star magnitude for different seeings produced by TSIM.

Findings

The automatic selection of the WFS mode depending on the flux did not work well. The mode look-up must to be redone properly using the measured performance as a criterion.

AI15 JFS: Add table with expected flux f (e- / full aperture / s) with open ND filter, scale to actual ADU measurement through ADU = f / framerate / 16 * gain * filter transmission (assume K-star spectrum).

The dynamic performance of the SAXO loop is excellent. Specification (TS 3.2.3 B. turbulent residual wavefront variance on corrected modes: 60 nm rms) is fulfilled when correcting for the static errors.

Dynamic Tip-Tilt residuals

Test condition: SAXO full-fledged on bright star, seeing 0.85", 12m/s
SPHERE_GEN_IRDIS303_00180001 : image cube (0.028s exp)
SPHERE_GEN_IRDIS303_00180002 : BG

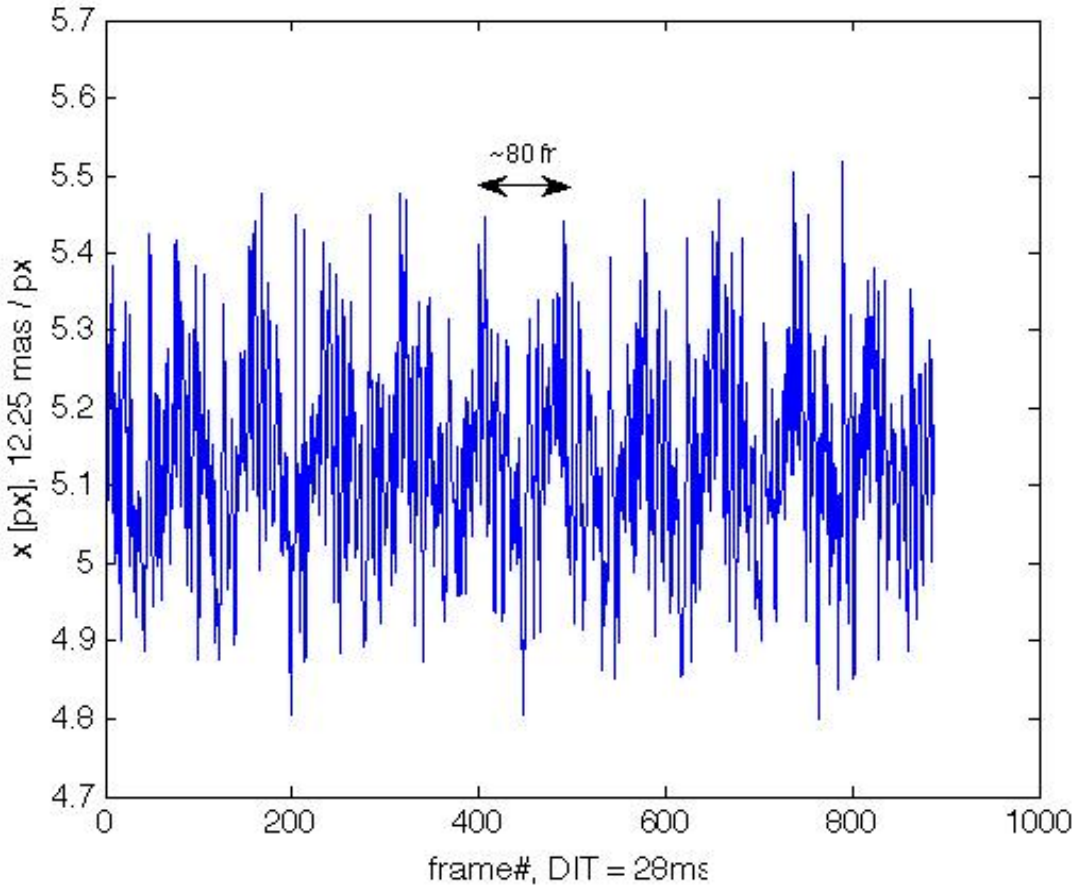


Figure 27. Spot position variation measured on short exposure (DIT = 28 ms) IRDIS images

Findings

The spot jitter was estimated by a center of gravity algorithm using small sub-windows of IRDIS that allow for 28ms DITs. The residual jitter was 0.9 mas rms in X and 1.6 mas rms in Y. These values are well within the specs and almost fulfill the goal specifications (TS 3.2.3A. residual TT: 3 mas rms (goal 1.5 mas)).

The Y jitter shows a ~80 frames, i.e. ~2.3 second period, oscillation with an amplitude of ~4 mas PTV.

Kalman test using the vibrating phasescreen (10 m/s, was vibrating)

1- Closed loop slopes and voltages + DTTS images - no Kalman
20131030_VisLoopData_CLTTOKMOFF/
SPHERE_GEN_IRDIS303_00180003

2- Closed loop slopes and voltages - Kalman
/data/SPARTA/20131030_VisLoopData_CL/

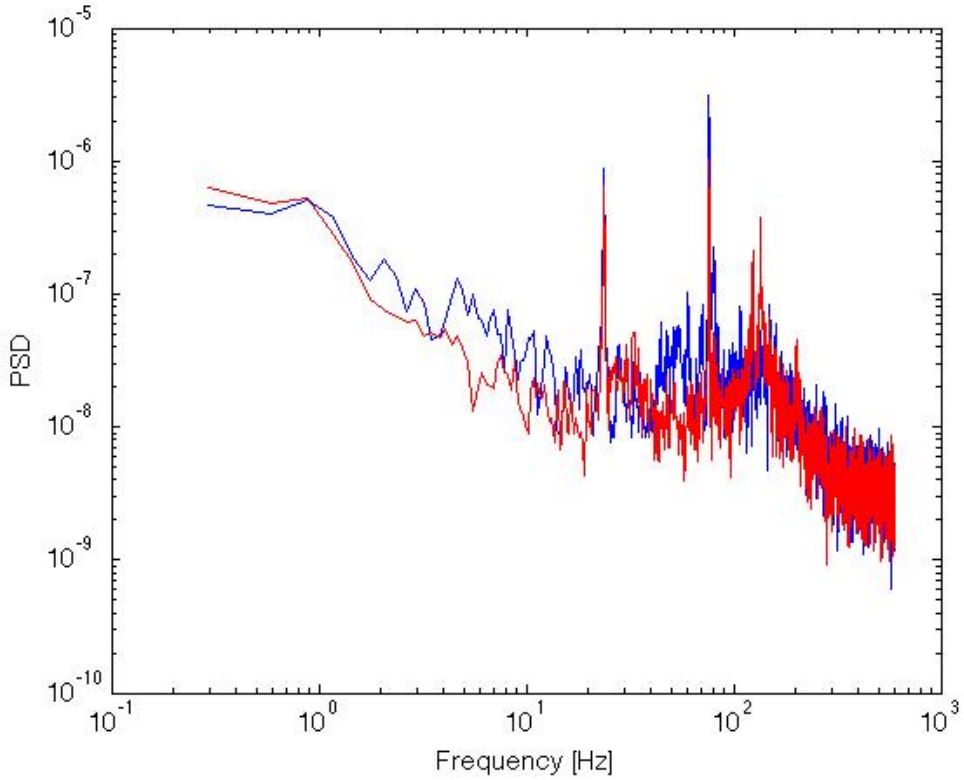


Figure 28. Residual jitter PSD (X and Y) measured with the WFS in closed loop

There are a number of vibration peaks clearly visible in the data. Kalman really active (tbc)?

The jitter standard deviations are however consistent with the values measured with IRDIS.

Another Kalman test on Oct 31:
/data/SPARTA/20131031_VisLoopData_ITTMpos/
includes ExposureDatCollector data

Findings:
TBD

14 Document and TRR RIX status

Review of updated documents wrt TRR RIXs
- CIDL (final document package incl. ESO docs, early Jan)
- Declaration of conformity (safety visit AIs): who signs? Inclusion of IFS and ZIMPOL not fully clear yet.
- CPI verif matrix (tbc Jean-Luc), Verif. matrices should refer to test report and not present the results at length

TRR RIX status

Closed, MKa:
56, 59, 60, 67, 69, 70, 72, 73, 79, 80, 116, 117, 118, 119, 120, 121, 123, 124, 125, 126, 128, 129, 131, 136, 137, 138, 139, 141, 154, 156, 157, 159, 160, 161, 163, 164, 166, 168, 169, 170, 171, 172-181, 183-185, 189, 455, 456, 457, 458, 459-464, 466, 467, 469-471, 494-496, 500-502, 506, 626, 639, 640, 766, 769, 771, 773, 798

Closed, RSI:
All

Closed, DMa:
132, 133, 134, 140, 142, 478, 480, 481, 482, 483, 485, 488, 492, 493, 498, 503, 504, 505, 563, 564, 663, 680, 684, 687, 695, 704, 706, 724, 725, 788, 789, 790, 791, 792, 793, 794, 795

Open, MKa
57: DL routines and Excel sheet for IRDIS alignment? "IDL macro program xxxxx.yyy" in 210 9.2.2.

58: open, update IDL macro program xxxxx.yyy

68: Cal module data package (for highres figure 2.3)?

71: check updated CIDL

74: check 433 for cal unit light levels and operation. -> Not presented. Table 12, p45, has errors. OPEN

75,76: 7.5. 5) "The FP4 fiber is checked by executing the SAXO-TEC-10 calibration sequence and verify the presence of the signal on the WFS in the 3rd step of the procedure". FP4 fiber is not seen by WFS, still to be corrected.

127: "Erreur ! Des objets ne peuvent pas être créés à partir des codes de champs de mise en forme." Figure 21

155: section 2.4. indicates that SPHERE will entirely autonomous during the AIT period at PAO. This is of course not the case. Please indicate the amount of support SPHERE will need for e.g. network infrastructure, general supplies, handling of cranes, transfer from NIH to telescope, logistics etc.

465: Auxiliary functions - table with IDL scripts?

497: Must conclude on HODM mask for Paranal. Shape? W/wo obscuration&spiders?

499: checkAO with turbulence

549-551: open, document 375 (CPI verif matrix not revised)

641: ITTM tuning procedure and spares still to be delivered

Open, DMa

135: Add a category TT at the telescope with 2 sub-categories (day and night). It would indeed be useful to know which tests can be carried out during the day.
Status: open

130: DRH expert should be present during all commissioning.
Status: open, staffing TBD.

479: All types of calibrations should be potentially integrated to the instrument health check (automatic plot generation), not just the Instrument monitoring ones.
Status: QC1 and insmon issues discussed during PAE tests. Action taken at DRH level (SPHERE TRAC tickets #410, 411).

503: lack of documentation concerning the management of configuration filesin this calibration plan.
Status: no action was taken, still open

661/787: WCS update after astometric calibration. Propagation the output of DRH, with appropriate coordinate of WCS. By rule, the pipeline cannot feedback to the INS WS. So has to be done manually by Paranal if required.
Status: TBDiscussed during commissioning by Paranal IS team => open

705: CalobBuild to be setup for commissioning in Paranal.
Status: documentation sent by Paranal IS, TBDiscussed during commissioning by Paranal IS team => open

15 AOB, discussions

Star_center does not robustly produce good results (IRDIS, ZIMPOL) or does not yet exist (IFS). Appears to be quite dependent on observing mode, SNR.
AI16 DRH/MFE to improve.

IFS_masterflat recipe to be run four times for data taken at 4 different wavelengths to produce 4 different flats. The chromatic difference between the flats is negligible (tbc). Please simplify if possible.

Parameters set to run IFS pipeline that should be available as a keyword in the fits header. ifs.spectra_positions.hmode = 1 or 0….

IFS spectral position calculation by **wave_cal recipe** does not deliver (large number of badly calculated spectra indicated in fits header). Why? IFS Calibration plan does not comment on flux levels required for proper functioning of pipeline…
AI17 DRH/MFE to improve

HODM humidity requirements. When to shut down (0 V) CODE and HODM? Threshold? 50% RH works fine at IPAG. 70% possibly ok as well as HODM is continuously flushed with dry air and kept dry. Threshold TBD, for now 50%!

Wed evening: IFS OB crashed. Long investigation. A **re-boot of the workstation was needed** which had accumulated a lot of Zombie processes.

Thu lunch: After successful completion of IFS OBs, the ZIMPOL OBs wouldn't run through. **Fix: Shut-down, startup, online of ZIMPOL NGC**. Off, online was not enough - feedback from Gerard?

Offset observed on ZIMPOL spot between the internal source (green laser) and the TSIM (halogen lamp). Chromatic tilt introduced by e.g. DTTP? Also the DTTS algorithm uses either COG or WCOG depending on acquisition which may introduce a small bias. **AI11 JFS/DMO to investigate.**

Cool tent. **No big chIller shipped to Chile**. Probably not needed as NIH is now pre-cooled by a heat exchanger to conditions similar to the ones at the IPAG lab (<~20 C).

Clean tent to be shipped upfront by sea.

SR measurement routine on SPHERE IRDIS images. Was supposed to be the NAOS routine. Maybe the NAOS routine is bad and has never been updated, because it produces unreasonable low measurements (on NAOS and on SPHERE, ref JIRA-47). **AI: JSa to send procedure to Dimitri -> DMa to give green light to ABa to implement.**

Related discussion on use of **HODM mask at the VLT**. New mask av? Pupil size accurate at the 1% level (tbd). Re-definition of active Subaperture mask may be need at PAO.
AI19 JLB: Produce new DM mask taking into account incidence angle and distance between HODM and mask.
AI: JSa: Confirm that modification of active subapertures can be done without problem. MSu (Nov 12): Not easily possible, WPU not configurable. Work-around by setting very high flux threshold for these subapertures such that the measurement is driven to zero.

Contrast QC parameter to classify OB? **AI20 DRH/MFe to implement DRH recipe for calculating contrast curve. Specifications from DMa (tbc).**

SAXO expert manual: Superficial requirements from PAO eng -> Details from Jeff -> technical details from Marcos

CAN RMC course of action: 1. JCh/SRo/GZi investigate (list of motors by Dan/Claudio/Andrea/Anne)? 2. Rolands visit.

CODE intervention: AI JLB to organize slot

TM3 schedule: ~Nov 9, INS installation, ~Nov 12 TM3 - one week of installation Nov 20 TM3 installed and motorized.

SPARTA intervention: Dec 2/3 (tbc): Slaving, 1380 Hz verification (not full implementation of mode), ordering.

AO WFS camera serial to go back (AI MKA to coordinate, period for 2 cameras at ESO mid Jan - early Feb '14)

VCS/DTTS remaining actions. AI MKA to discuss with LAL about option to ship back part of DTTS. closed - email Nov 13.

HODM/TM3 adjustment procedure. Keep it simple, user initiated template to adjust for the actual conditions. Can then be used to build up lookup table for automatic adjustment at a later stage...

16 Summary Action Items

Id	Description	Assigned to	Due date
AI 1	SPHERE-68: modification to matrix optimizer template, SAXO engineering panel modification for this sign.	INS/ABA	PAE
AI 2	SPHERE-65: Implement JFS proposal for SAXO keywords in header	INS/ABA	PAE
AI 3	SPHERE-83: generate ordering vector that matches subapertures with actuators	JFS	30 Nov 2013
AI 4	SPHERE-30: clarify the need for resume closed loop with SPHERE and PAO	INS/ABA	PAE
AI 5	SPHERE-32: Clarify type and tool for archival (through template, like SPHERE_gen_tec_save_clmatrices, seems acceptable). Clarify trending requirements with JFS	INS/ABA	PAE
AI 6	VLTSW-9732/10311: Clarify type and tool for archival from INS_ROOT at PAO	PAO-INS/CRE	PAE
AI 7	SPHERE-77: Remove copy button	GZI	PAE
AI 8	IDL-tools: Popose list of tools with a decription (purpose, frequency,...) to PAO engineers	SPHERE/JLB	PAE
AI 9	Dead actuator list modification: Update of procedure in doc 0675	JFS	PAE
AI 10	SAXO modes as a function of observing conditions: the lookup table is faulty and needs to be updated	JFS	Comm1
AI 11	Shift in spot position between internal source and TSIM/sky: Verify whether switch from COG to WCOG for DTTS is responsible. Verify whether bad bottom row causes pb. If yes, set it to zero in DTTS FF.	JFS	Comm1
AI 12	SPHERE_gen_cal_wsfw_refslopes_nir: Modify to select lightsource before moving the fiber in.	JFS / ABA	Comm1
AI13	NCPA: Currently the NCPA calibration process is not robust and deteriorates after the first iteration. Investigate origin and report.	JFS	PAE
AI14	CheckAO: Specify (JFS) and implement (ABA) turbulent voltage replay.	JFS / ABA	Comm1
AI 15	Prepare table for SAXO user manual with expected flux f (e- / full aperture / s) with open ND filter, scale to actual ADU measurement through ADU = f / framerate / 16 * gain * filter transmission (assume K-star spectrum).	JFS	PAE

AI 16	Improve/debug star_center recipe	DRH/MFE	Comm1
AI 17	Improve/debug IFS wave_cal recipe	DRH/MFE	Comm1
AI 18	Improve/debug Strehl ratio recipe (SPHERE-47)	DRH/LLU	Comm1
AI 19	HODM mask: Produce new mask (only external circular stop) taking into account incidence angle and distance between HODM and mask	JLB	Comm1
AI 20	Contrast estimation for QC. Specify	DMa,	PAE
AI 21	Contrast estimation for QC. Implement (SPHERE TRAC #411)	DRH/MFe	Comm1
AI 22	Implement new Lyot stops masking bad actuators	KDo	Comm1
PAN1	SAXO RTD: add Strehl ratio from Sparta RTC, add guide star magnitude estimate (to be recalibrated during commissioning), make the main loop parameters visible (WFS frequency, SF, OMGI plot, add alarm for Kalman filter?, tbd).	GZI	Comm1
PAN2	SOS panel: make it more “useful” a la SINFONI (good example). “safe state”, “close loop” buttons shall be implemented, etc. Tabs relaying critical Saxo parameters shall be implemented (Strehl ratio, guide star magnitude, etc.)	GZI	Comm1
PAN3	2 screens WILL NOT be sufficient (space taken by SCIENCE instrument GUIs is too big to be manageable with 2 screens). D. Mawet will ask Andrew Wright (MCR) about getting additional screens and/or terminals. N. Schuhler suggest 2 terminals, each with 2 screens.	INS/ABa	Comm1
DIC1	Improve quality of the dictionary. This shall be done according to email by Adam (a) solving some technical inconsistencies, such as avoiding acronyms in the label of the fits header, including the correct units of the parameter and b) moving keywords that are irrelevant for the outside astronomers into the ops log.	DMo	PAE
QC1	Prepare photometric zero point recipe for IRDIS and ZIMPOL’s broadband filters (SPHERE TRAC #410).	MFe	Comm1
DFO1	Commissioning plan to be revised according to PAE tested modes (P0 and P1)	DMo	PAE
ETC1	Clean up the ETC out-put and provide a debugging version of the ETC (high verbose level needed from Klara to DMo)	DMo	PAE
ETC2	After bug fixing get ETC populated by all other instrument configurations. USD scientist should be consulted.	DMo	PAE
ETC3	Add uncertainty to contrast curves	DMo	PAE

17 Conclusion

During the PAE test run all templates that are classified by the Consortium to be in priority 0 and priority 1 category were executed. All templates run smoothly.

Various instrument panels such as RTD, P2PP, BOB, NGC, ICS, etc. were inspected and appear ready for science operations. A few tweaks are foreseen during commissioning and early operations, as a function of on-sky experience to improve operability.

The pipeline processed all data obtained. The DRH data products were inspected. A number of DRH actions are identified that will improve the science quality of the data products further. QC1 parameters are extracted and are under review. A few QC1 parameters are missing or still to be clearly defined, but actions were taken between relevant actors: e.g. Strehl ratio, dynamic and static contrast curves and figures. The latter are also being considered as QC0 parameters to be used in Paranal for OB classification during service mode, raising their priority for implementation as post-PAE actions. Technical issues on the DRH system that are identified as open tickets shall be closed by the end of Jan and performance issues that are relevant for Com1 shall be closed 6 weeks before night-time observations at the VLT.

The DFO documents are reviewed against the RIX that have been raised during TRR. The documents appear in a good state although they need to be updated against the findings of the PAE verification (e.g. removal of priority 2 template descriptions, identification of new calibration tasks relevant for science operations, commissioning plan, etc.).

There are pending question related to the final calibration plan for IFS (necessity of internal chromatic flats is questionable) and especially for ZIMPOL (how far does the user want to calibrate instrumental polarization?), and will be addressed as on-sky experience builds up during commissioning. We noted that all the necessary tools and template are ready and functional.

It is recommended to re-do all the tests in Paranal before deciding to start-up of night-time commissioning. These data that will be taken at Paranal shall be processed by the pipeline and compared to the results obtained in the present run at the Grenoble laboratory. For ease of doing this, a data package will be delivered by the Consortium to ESO including all raw data and pipeline products as well as the P2PP input files of the observations.

The dictionary needs to be updated following the recommendations provided by DICB.

The ETC panel appear fine however computational errors are identified that need to be corrected. Thereafter, the ETC needs to be upgraded to cope with other instrument configurations.

Performance wise, SPHERE appears to fulfil its basic specification barely. The main culprit is clearly identified as being the deformable mirror dead actuators, which contaminate the coronagraph pupil directly. Action has been taken by the consortium to prevent further degradation of the DM, as well as to mitigate the effect of the current dead actuators: a set of new Lyot stops are being manufactured and will be installed prior to shipping to Paranal. It has been verified during the PAE that the new Lyot stops will indeed restore SPHERE's nominal performance as measured before the loss.

Finally, priority 2 template will not be addressed during the commissioning, and will provide the basis of future SPHERE upgrades.

18 Appendix A: Observing blocks as executed

18.1 IRDIS_-_DBI_-_NDH23+NH32_-_calib.obx

```
IMPEX.VERSION "2.0"
type                    "O"
STTimeIntervals         ""
calibrationReq          ""
InstrumentComments      ""
userComments            ""
userPriority            "1"
LineNumber              "0"
name                    "IRDIS - DBI - NDH23+NH32 - calib"

comments                ""
objectClass             ""
ra                      " 00:00:00.000"
dec                     " 00:00:00.000"
epoch                   "2000.0"
equinox                 "2000"
propDec                 "0.000000"
propRA                  "0.000000"
diffRA                  "0.000000"
diffDec                 "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"

air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                      "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"

longDescription             ""
IPVersion                   "10.3"
instrument                  "SPHERE"
LineNumber                  "0"
OBSERVATION.DESCRIPTION.NAME "No Name"
```

```
#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "4"
SEQ.NDIT.LIST              "20"
INS.COMB.ICOR               "N_ALC_YJH_S"
INS.COMB.IFLT              "DB_NDH23"
INS.COMB.IND               "ND_N_1.0"
INS.COMB.POLA               "N_I"

SPHERE_IRDIS_DARK296_0005.fits


#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "4"
SEQ.NDIT.LIST              "20"
INS.COMB.ICOR               "N_ALC_YJH_S"
INS.COMB.IFLT              "DB_NDH32"
INS.COMB.IND               "ND_N_1.0"
INS.COMB.POLA               "N_I"

SPHERE_IRDIS_DARK296_0006.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "2"
SEQ.NDIT.LIST              "20"
INS.COMB.ICOR               "N_ALC_YJH_S"
INS.COMB.IFLT              "DB_NDH23"
INS.COMB.IND               "ND_N_3.5"
INS.COMB.POLA               "N_I"

SPHERE_IRDIS_DARK296_0007.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "2"
```

```
SEQ.NDIT.LIST             "20"
INS.COMB.ICOR              "N_ALC_YJH_S"
INS.COMB.IFLT             "DB_NDH32"
INS.COMB.IND              "ND_N_3.5"
INS.COMB.POLA              "N_I"

SPHERE_IRDIS_DARK296_0008.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_flat"
DET.READOUT          "Nondest"
SEQ.DIT.LIST         "1 2 3 4 5"
SEQ.NDIT.LIST        "5 5 5 5 5"
INS.COMB.CAL          "FF_VIS_NIR_ND1.0"
INS.COMB.ICOR         "N_NS_CLEAR"
INS.COMB.IFLT         "DB_NDH23"
INS.COMB.IND          "ND_N_1.0"
INS.COMB.POLA         "N_I"

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_flat"
DET.READOUT          "Nondest"
SEQ.DIT.LIST         "1 2 3 4 5"
SEQ.NDIT.LIST        "5 5 5 5 5"
INS.COMB.CAL          "FF_VIS_NIR_ND1.0"
INS.COMB.ICOR         "N_NS_CLEAR"
INS.COMB.IFLT         "DB_NDH32"
INS.COMB.IND          "ND_N_1.0"
INS.COMB.POLA         "N_I"

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_distmap"
DET.DIT               "2.5"
DET.NDIT               "2"
INS.COMB.CAL             "DIST_VIS_NIR_ND1.5"
INS.COMB.ICOR           "N_ALC_YJH_S"
INS.COMB.IFLT           "DB_NDH23"
INS.COMB.POLA           "N_I_GRID"

#
```

```
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_distmap"
DET.DIT               "2.5"
DET.NDIT               "2"
INS.COMB.CAL          "DIST_VIS_NIR_ND1.5"
INS.COMB.ICOR          "N_ALC_YJH_S"
INS.COMB.IFLT         "DB_NDH32"
INS.COMB.POLA          "N_I_GRID"
```

18.2 **IRDIS_-_DBI_-_J23_-_calib.obx**

```
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "1.5"
SEQ.NDIT.LIST              "20"
INS.COMB.ICOR               "N_ALC_YJH_S"
INS.COMB.IFLT              "DB_J23"
INS.COMB.IND               "ND_N_1.0"
INS.COMB.POLA               "N_I"

SPHERE_IRDIS_DARK296_0021.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "2.5"
SEQ.NDIT.LIST              "20"
INS.COMB.ICOR               "N_ALC_YJH_S"
INS.COMB.IFLT              "DB_J23"
INS.COMB.IND               "ND_N_3.5"
INS.COMB.POLA               "N_I"

SPHERE_IRDIS_DARK296_0022.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_flat"
DET.READOUT          "Nondest"
SEQ.DIT.LIST        "2.5 3 3.5 4 5"
SEQ.NDIT.LIST        "5 5 5 5 5"
INS.COMB.CAL         "FF_VIS_NIR_ND3.0"
INS.COMB.ICOR        "N_NS_CLEAR"
INS.COMB.IFLT        "DB_J23"
INS.COMB.IND         "ND_N_0.0"
INS.COMB.POLA         "N_I"

SPHERE_IRDIS_DARK296_0023.fits
SPHERE_IRDIS_DARK296_0024.fits
SPHERE_IRDIS_DARK296_0025.fits
SPHERE_IRDIS_DARK296_0026.fits
SPHERE_IRDIS_DARK296_0027.fits
```

SPHERE_IRDIS_FLAT296_0014.fits
SPHERE_IRDIS_FLAT296_0015.fits
SPHERE_IRDIS_FLAT296_0016.fits
SPHERE_IRDIS_FLAT296_0017.fits
SPHERE_IRDIS_FLAT296_0018.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_distmap"
DET.DIT "1.5"
DET.NDIT "5"
INS.COMB.CAL "DIST_VIS_NIR_ND2.0"
INS.COMB.ICOR "N_ALC_YJH_S"
INS.COMB.IFLT "DB_J23"
INS.COMB.POLA "N_I_GRID"

SPHERE_IRDIS_DISTORT296_0003.fits

18.3 **IRDIS_-_DBI_-_J23_-_obs.obx**

```
#
#
ACQUISITION.TEMPLATE.NAME "SPHERE_irdis_acq_imaging"
SEQ.DO.CENTERING        "T"
SEQ.DO.FOCUS            "T"
SEQ.DTTS.BACKGND        "F"
SEQ.DTTS.DIT            "1"
SEQ.IR.GAIN             "0.4"
SEQ.OBS.TYPE            "NON_POLA"
SEQ.PRESET              "T"
SEQ.PUP.GAIN            "0.0"
SEQ.TARGET.HMAG         "0"
SEQ.TARGET.RMAG         "0"
SEQ.VISHO.GAIN          "0"
SEQ.VISTT.GAIN          "0.05"
SEQ.VWFS.BACKGND        "F"
SEQ.VWFS.DIT            "1"
TEL.TARG.TYPE           "COORDINATE"
TEL.TARG.OFFSETALPHA    "5"
TEL.TARG.OFFSETDELTA    "5"
TEL.GS1.ALPHA           "0."
TEL.GS1.DELTA           " 00:00:00.000"
TEL.GS1.MAG             "12."
INS.COMB.ICOR           "N_ALC_YJ_S"
INS.COMB.ROT            "PUPIL"
INS.CPRT.POSANG         "0.0"

#
#
#
TEMPLATE.NAME "SPHERE_irdis_obs_star_center"
DET.DIT                 "1.5"
DET.NDIT                "10"
SEQ.SWAP                "F"
SEQ.WAFFLE.AMPLITUDE    "0.015"
INS.COMB.IFLT           "DB_J23"
INS.COMB.IND            "ND_N_1.0"
INS.COMB.ROT            "PUPIL"
INS.CPRT.POSANG         "0.0"

#
#
```

```
#
TEMPLATE.NAME "SPHERE_irdis_obs_exp_DBI"
DET.DIT               "1.5"
DET.NDIT              "20"
SEQ.DITH.PATTERN      "4x4"
SEQ.DITH.PATTERN.NB   "1"
SEQ.DITH.STOP.POS     "0"
SEQ.NEXPO             "1"
SEQ.SWAP              "F"
INS.COMB.IFLT         "DB_J23"
INS.COMB.IND          "ND_N_1.0"
INS.COMB.ROT          "PUPIL"
INS.CPRT.POSANG       "0.0"

#
#
#
TEMPLATE.NAME "SPHERE_irdis_obs_star_center"
DET.DIT                  "1.5"
DET.NDIT                 "10"
SEQ.SWAP                 "F"
SEQ.WAFFLE.AMPLITUDE     "0.015"
INS.COMB.IFLT            "DB_J23"
INS.COMB.IND             "ND_N_1.0"
INS.COMB.ROT             "PUPIL"
INS.CPRT.POSANG          "0.0"

#
#
#
TEMPLATE.NAME "SPHERE_irdis_obs_flux"
DET.DIT            "2.5"
DET.NDIT           "10"
SEQ.DET.TARG.OFFSETX  "500"
SEQ.DET.TARG.OFFSETY  "500"
INS.COMB.IFLT      "DB_J23"
INS.COMB.IND       "ND_N_3.5"
INS.CPRT.POSANG    "0.0"
```

18.4 **IRDIS_-_CI_-_H_-_calib.obx**

```
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "4"
SEQ.NDIT.LIST             "10"
INS.COMB.ICOR               "N_ALC_YJH_S"
INS.COMB.IFLT             "BB_H"
INS.COMB.IND              "ND_N_2.0"
INS.COMB.POLA               "N_I"

SPHERE_IRDIS_DARK296_0030.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "0"
SEQ.NDIT.LIST             "10"
INS.COMB.ICOR               "N_ALC_YJH_S"
INS.COMB.IFLT             "BB_H"
INS.COMB.IND              "ND_N_3.5"
INS.COMB.POLA               "N_I"

SPHERE_IRDIS_DARK296_0031.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_flat"
DET.READOUT           "Nondest"
SEQ.DIT.LIST        "0 1 1.25 1.5 1.75 2"
SEQ.NDIT.LIST       "5 5 5 5 5 5"
INS.COMB.CAL         "FF_VIS_NIR_ND2.0"
INS.COMB.ICOR        "N_NS_CLEAR"
INS.COMB.IFLT       "BB_H"
INS.COMB.IND        "ND_N_1.0"
INS.COMB.POLA        "N_I"

SPHERE_IRDIS_DARK296_0032.fits
SPHERE_IRDIS_DARK296_0033.fits
SPHERE_IRDIS_DARK296_0034.fits
SPHERE_IRDIS_DARK296_0035.fits
SPHERE_IRDIS_DARK296_0036.fits
SPHERE_IRDIS_DARK296_0037.fits
```

SPHERE_IRDIS_FLAT296_0020.fits
SPHERE_IRDIS_FLAT296_0021.fits
SPHERE_IRDIS_FLAT296_0022.fits
SPHERE_IRDIS_FLAT296_0023.fits
SPHERE_IRDIS_FLAT296_0024.fits
SPHERE_IRDIS_FLAT296_0025.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_distmap"
DET.DIT "2"
DET.NDIT "5"
INS.COMB.CAL "DIST_VIS_NIR_ND3.0"
INS.COMB.ICOR "N_ALC_YJH_S"
INS.COMB.IFLT "BB_H"
INS.COMB.POLA "N_I_GRID"

SPHERE_IRDIS_DISTORT296_0004.fits

18.5 **IRDIS_-_CI_-_H_-_obs.obx**

```
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "4"
SEQ.NDIT.LIST             "10"
INS.COMB.ICOR               "N_ALC_YJH_S"
INS.COMB.IFLT             "BB_H"
INS.COMB.IND              "ND_N_2.0"
INS.COMB.POLA               "N_I"

SPHERE_IRDIS_DARK296_0030.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "0"
SEQ.NDIT.LIST             "10"
INS.COMB.ICOR               "N_ALC_YJH_S"
INS.COMB.IFLT             "BB_H"
INS.COMB.IND              "ND_N_3.5"
INS.COMB.POLA               "N_I"

SPHERE_IRDIS_DARK296_0031.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_flat"
DET.READOUT           "Nondest"
SEQ.DIT.LIST        "0 1 1.25 1.5 1.75 2"
SEQ.NDIT.LIST        "5 5 5 5 5 5"
INS.COMB.CAL          "FF_VIS_NIR_ND2.0"
INS.COMB.ICOR         "N_NS_CLEAR"
INS.COMB.IFLT        "BB_H"
INS.COMB.IND         "ND_N_1.0"
INS.COMB.POLA         "N_I"

SPHERE_IRDIS_DARK296_0032.fits
SPHERE_IRDIS_DARK296_0033.fits
SPHERE_IRDIS_DARK296_0034.fits
SPHERE_IRDIS_DARK296_0035.fits
SPHERE_IRDIS_DARK296_0036.fits
SPHERE_IRDIS_DARK296_0037.fits
```

SPHERE_IRDIS_FLAT296_0020.fits
SPHERE_IRDIS_FLAT296_0021.fits
SPHERE_IRDIS_FLAT296_0022.fits
SPHERE_IRDIS_FLAT296_0023.fits
SPHERE_IRDIS_FLAT296_0024.fits
SPHERE_IRDIS_FLAT296_0025.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_cal_distmap"
DET.DIT "2"
DET.NDIT "5"
INS.COMB.CAL "DIST_VIS_NIR_ND3.0"
INS.COMB.ICOR "N_ALC_YJH_S"
INS.COMB.IFLT "BB_H"
INS.COMB.POLA "N_I_GRID"

SPHERE_IRDIS_DISTORT296_0004.fits

wsre sphere:/insroot/SPHERE/SYSTEM/DETDATA 1042 > m ~/david/P2PP_October13/IRDIS_-_CI_-_H_-_obs.obx
ACQUISITION.TEMPLATE.NAME "SPHERE_irdis_acq_imaging"
SEQ.DO.CENTERING "F"
SEQ.DO.FOCUS "F"
SEQ.DTTS.BACKGND "F"
SEQ.DTTS.DIT "1"
SEQ.IR.GAIN "0.4"
SEQ.OBS.TYPE "NON_POLA"
SEQ.PRESET "T"
SEQ.PUP.GAIN "0.0"
SEQ.TARGET.HMAG "0"
SEQ.TARGET.RMAG "0"
SEQ.VISHO.GAIN "0"
SEQ.VISTT.GAIN "0.05"
SEQ.VWFS.BACKGND "F"
SEQ.VWFS.DIT "1"
TEL.TARG.TYPE "COORDINATE"
TEL.TARG.OFFSETALPHA "5"
TEL.TARG.OFFSETDELTA "5"
TEL.GS1.ALPHA "0."
TEL.GS1.DELTA "0."
TEL.GS1.MAG "12."
INS.COMB.ICOR "N_ALC_YJH_S"
INS.COMB.ROT "PUPIL"

INS.CPRT.POSANG "0.0"

#
#
#
TEMPLATE.NAME "SPHERE_irdis_obs_star_center"
DET.DIT "4"
DET.NDIT "5"
SEQ.SWAP "F"
SEQ.WAFFLE.AMPLITUDE "0.015"
INS.COMB.IFLT "BB_H"
INS.COMB.IND "ND_N_2.0"
INS.COMB.ROT "PUPIL"
INS.CPRT.POSANG "0.0"

SPHERE_IRDIS_OBS296_0061.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdis_obs_exp_CI"
DET.DIT "4"
DET.NDIT "15"
SEQ.DITH.PATTERN "4x4"
SEQ.DITH.PATTERN.NB "1"
SEQ.DITH.STOP.POS "0"
SEQ.NEXPO "1"
INS.COMB.IFLT "BB_H"
INS.COMB.IND "ND_N_2.0"
INS.COMB.ROT "FIELD"
INS.CPRT.POSANG "0.0"

SPHERE_IRDIS_OBS296_0062.fits
SPHERE_IRDIS_OBS296_0063.fits
SPHERE_IRDIS_OBS296_0064.fits
SPHERE_IRDIS_OBS296_0065.fits
SPHERE_IRDIS_OBS296_0066.fits
SPHERE_IRDIS_OBS296_0067.fits
SPHERE_IRDIS_OBS296_0068.fits
SPHERE_IRDIS_OBS296_0069.fits
SPHERE_IRDIS_OBS296_0070.fits
SPHERE_IRDIS_OBS296_0071.fits
SPHERE_IRDIS_OBS296_0072.fits
SPHERE_IRDIS_OBS296_0073.fits
SPHERE_IRDIS_OBS296_0074.fits
SPHERE_IRDIS_OBS296_0075.fits

SPHERE_IRDIS_OBS296_0076.fits
SPHERE_IRDIS_OBS296_0077.fits
#
#
#
TEMPLATE.NAME "SPHERE_irdis_obs_star_center"
DET.DIT "4"
DET.NDIT "5"
SEQ.SWAP "F"
SEQ.WAFFLE.AMPLITUDE "0.015"
INS.COMB.IFLT "BB_H"
INS.COMB.IND "ND_N_2.0"
INS.COMB.ROT "PUPIL"
INS.CPRT.POSANG "0.0"

#
#
#
TEMPLATE.NAME "SPHERE_irdis_obs_flux"
DET.DIT "0"
DET.NDIT "5"
SEQ.DET.TARG.OFFSETX "500"
SEQ.DET.TARG.OFFSETY "500"
INS.COMB.IFLT "BB_H"
INS.COMB.IND "ND_N_3.5"
INS.CPRT.POSANG "0.0"

18.6 **IRDIS_-_MRS_-_calib.obx**

```
IMPEX.VERSION "2.0"
type                    "O"
STTimeIntervals         ""
calibrationReq          ""
InstrumentComments      ""
userComments            ""
userPriority            "1"
LineNumber              "0"
name                    "IRDIS - MRS - calib"


comments                ""
objectClass             " Unknown           "
ra                    " 00:00:00.000"
dec                   " 00:00:00.000"
epoch                   "2000.0"
equinox                 "2000"
propDec                 "0.000000"
propRA                  "0.000000"
diffRA                  "0.000000"
diffDec                 "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"


air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                      "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"


longDescription             ""
IPVersion                   "10.3"
instrument                  "SPHERE"
LineNumber                  "0"
OBSERVATION.DESCRIPTION.NAME "No Name"


TEMPLATE.NAME "SPHERE_irdis_cal_background"
```

```
SEQ.DIT.LIST              "2"
SEQ.NDIT.LIST              "50"
INS.COMB.ICOR               "N_S_MR_NL"
INS.COMB.IFLT              "S_LR"
INS.COMB.IND               "ND_N_1.0"
INS.COMB.POLA               "N_I"


TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "0"
SEQ.NDIT.LIST              "50"
INS.COMB.ICOR               "N_S_MR_NL"
INS.COMB.IFLT              "S_LR"
INS.COMB.IND               "ND_N_3.5"
INS.COMB.POLA               "N_I"


TEMPLATE.NAME "SPHERE_irdis_cal_wave"
DET.DIT             "2"
DET.NDIT             "10"
INS.COMB.ICOR        "N_S_MR_NL"


TEMPLATE.NAME "SPHERE_irdis_cal_flat"
DET.READOUT          "Nondest"
SEQ.DIT.LIST         "1 2"
SEQ.NDIT.LIST         "1 1"
INS.COMB.CAL          "FF_VIS_NIR_ND4.0"
INS.COMB.ICOR         "N_S_MR_OPEN"
INS.COMB.IFLT         "S_LR"
INS.COMB.IND          "ND_N_0.0"
INS.COMB.POLA         "N_I"


TEMPLATE.NAME "SPHERE_irdis_cal_flat"
DET.READOUT          "Nondest"
SEQ.DIT.LIST         "0.84 1.0 1.2 1.45 1.7"
SEQ.NDIT.LIST         "5 5 5 5 5"
INS.COMB.CAL          "FF_VIS_NIR_ND4.0"
INS.COMB.ICOR         "N_NS_CLEAR"
INS.COMB.IFLT         "S_LR"
INS.COMB.IND          "ND_N_0.0"
INS.COMB.POLA         "N_I"
```

18.7 **IRDIS_-_MRS_-_obs.obx**

```
IMPEX.VERSION "2.0"
type                    "O"
STTimeIntervals         ""
calibrationReq          ""
InstrumentComments      ""
userComments            ""
userPriority            "1"
LineNumber              "0"
name                    "IRDIS - MRS - obs"


comments                ""
objectClass             " Unknown           "
ra                    " 00:00:00.000"
dec                    "-80:00:00.000"
epoch                   "2000.0"
equinox                 "2000"
propDec                 "0.000000"
propRA                  "0.000000"
diffRA                 "0.000000"
diffDec                "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"


air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                     "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"


longDescription             ""
IPVersion                  "10.3"
instrument                 "SPHERE"
LineNumber                  "0"
OBSERVATION.DESCRIPTION.NAME "No Name"


ACQUISITION.TEMPLATE.NAME "SPHERE_irdis_acq_spectro"
```

SEQ.DO.CENTERING "T"
SEQ.DTTS.BACKGND "F"
SEQ.DTTS.DIT "1"
SEQ.IR.GAIN "0.4"
SEQ.PRESET "T"
SEQ.PUP.GAIN "0.0"
SEQ.TARGET.HMAG "0"
SEQ.TARGET.RMAG "0"
SEQ.VISHO.GAIN "0"
SEQ.VISTT.GAIN "0.05"
SEQ.VWFS.BACKGND "F"
SEQ.VWFS.DIT "1"
TEL.TARG.TYPE "COORDINATE"
TEL.TARG.OFFSETALPHA "5"
TEL.TARG.OFFSETDELTA "5"
TEL.GS1.ALPHA "0."
TEL.GS1.DELTA "0."
TEL.GS1.MAG "12."
INS.COMB.ICOR "N_S_MR_NL"
INS.CPRT.POSANG "0.0"

TEMPLATE.NAME "SPHERE_irdis_obs_exp_LSS"
DET.DIT "2"
DET.NDIT "50"
SEQ.NEXPO "1"
INS.COMB.IND "ND_N_0.0"
INS.CPRT.POSANG "0.0"

TEMPLATE.NAME "SPHERE_irdis_obs_telluric"
DET.DIT "0"
DET.NDIT "50"
SEQ.DET.TARG.OFFSETX "500"
INS.COMB.IND "ND_N_3.5"

18.8 **IRDIS_-_LRS_-_calib.obx**

```
IMPEX.VERSION "2.0"
type                    "O"
STTimeIntervals         ""
calibrationReq          ""
InstrumentComments      ""
userComments            ""
userPriority            "1"
LineNumber              "0"
name                    "IRDIS - LRS - calib"


comments                ""
objectClass             " Unknown           "
ra                    " 00:00:00.000"
dec                   " 00:00:00.000"
epoch                   "2000.0"
equinox                 "2000"
propDec                 "0.000000"
propRA                  "0.000000"
diffRA                  "0.000000"
diffDec                 "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"


air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                      "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"


longDescription         ""
IPVersion               "10.3"
instrument              "SPHERE"
LineNumber              "0"
OBSERVATION.DESCRIPTION.NAME "No Name"
```

```
TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "0"
SEQ.NDIT.LIST             "50"
INS.COMB.ICOR              "N_S_LR_WL"
INS.COMB.IFLT             "S_LR"
INS.COMB.IND              "ND_N_1.0"
INS.COMB.POLA              "N_I"


TEMPLATE.NAME "SPHERE_irdis_cal_background"
SEQ.DIT.LIST              "0"
SEQ.NDIT.LIST             "50"
INS.COMB.ICOR              "N_S_LR_WL"
INS.COMB.IFLT             "S_LR"
INS.COMB.IND              "ND_N_3.5"
INS.COMB.POLA              "N_I"


TEMPLATE.NAME "SPHERE_irdis_cal_wave"
DET.DIT             "0"
DET.NDIT            "10"
INS.COMB.ICOR       "N_S_LR_WL"


TEMPLATE.NAME "SPHERE_irdis_cal_flat"
DET.READOUT         "Nondest"
SEQ.DIT.LIST        "1 2"
SEQ.NDIT.LIST       "1 1"
INS.COMB.CAL        "FF_VIS_NIR_ND4.0"
INS.COMB.ICOR       "N_S_LR_OPEN"
INS.COMB.IFLT       "S_LR"
INS.COMB.IND        "ND_N_0.0"
INS.COMB.POLA       "N_I"


TEMPLATE.NAME "SPHERE_irdis_cal_flat"
DET.READOUT         "Nondest"
SEQ.DIT.LIST        "0.84 1.0 1.2 1.45 1.7"
SEQ.NDIT.LIST       "5 5 5 5 5"
INS.COMB.CAL        "FF_VIS_NIR_ND4.0"
INS.COMB.ICOR       "N_NS_CLEAR"
INS.COMB.IFLT       "S_LR"
INS.COMB.IND        "ND_N_0.0"
INS.COMB.POLA       "N_I"
```

18.9 **IRDIS_-_LRS_-_obs.obx**

```
IMPEX.VERSION "2.0"
type                    "O"
STTimeIntervals         ""
calibrationReq          ""
InstrumentComments      ""
userComments            ""
userPriority            "1"
LineNumber              "0"
name                    "IRDIS - LRS - obs"


comments                ""
objectClass             " Unknown           "
ra                    " 00:00:00.000"
dec                    "-80:00:00.000"
epoch                   "2000.0"
equinox                 "2000"
propDec                 "0.000000"
propRA                  "0.000000"
diffRA                 "0.000000"
diffDec                "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"


air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                     "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"


longDescription             ""
IPVersion                  "10.3"
instrument                 "SPHERE"
LineNumber                  "0"
OBSERVATION.DESCRIPTION.NAME "No Name"
```

```
ACQUISITION.TEMPLATE.NAME "SPHERE_irdis_acq_spectro"
SEQ.DO.CENTERING         "T"
SEQ.DTTS.BACKGND         "F"
SEQ.DTTS.DIT             "1"
SEQ.IR.GAIN              "0.4"
SEQ.PRESET               "T"
SEQ.PUP.GAIN             "0.0"
SEQ.TARGET.HMAG          "0"
SEQ.TARGET.RMAG          "0"
SEQ.VISHO.GAIN           "0"
SEQ.VISTT.GAIN           "0.05"
SEQ.VWFS.BACKGND         "F"
SEQ.VWFS.DIT             "1"
TEL.TARG.TYPE            "COORDINATE"
TEL.TARG.OFFSETALPHA     "5"
TEL.TARG.OFFSETDELTA     "5"
TEL.GS1.ALPHA            "0."
TEL.GS1.DELTA            "0."
TEL.GS1.MAG              "12."
INS.COMB.ICOR            "N_S_LR_WL"
INS.CPRT.POSANG          "0.0"



TEMPLATE.NAME "SPHERE_irdis_obs_exp_LSS"
DET.DIT                  "0"
DET.NDIT                 "50"
SEQ.NEXPO                "4"
INS.COMB.IND             "ND_N_1.0"
INS.CPRT.POSANG          "0.0"


TEMPLATE.NAME "SPHERE_irdis_obs_telluric"
DET.DIT                  "0"
DET.NDIT                 "50"
SEQ.DET.TARG.OFFSETX     "500"
INS.COMB.IND             "ND_N_3.5"
```

18.10 **IRDIFS-NIROBS-calibrations.obx**

```
#
#
TEMPLATE.NAME "SPHERE_irdifs_cal_dark"
SEQ.IFS.DIT.LIST       "2"
SEQ.IFS.NDIT.LIST      "50"
SEQ.IRDIS.DIT.LIST     "0.84 1.6"
SEQ.IRDIS.NDIT.LIST    "50 50"
SEQ.READOUT.LIST       "Double Double"

SPHERE_IRDIFS_DARK_IRDIS296_0001.fits
SPHERE_IRDIFS_DARK_IFS296_0001.fits
SPHERE_IRDIFS_DARK_IRDIS296_0002.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdifs_cal_flat"
SEQ.COMB.CAL.LIST      "FF_VIS_NIR_ND1.5"
SEQ.COMB.IFLT.LIST     "DB_H23 DB_H23 DB_H23 DB_H23 DB_H23 DB_H32
DB_H32 DB_H32
DB_H32 DB_H32"
SEQ.COMB.IFS.LIST      "CAL_BB_2_YJ CAL_BB_2_YJ"
SEQ.IFS.DIT.LIST       "2 10"
SEQ.IFS.NDIT.LIST      "20 20"
SEQ.IRDIS.DIT.LIST     "1 2 3 4 5 1 2 3 4 5"
SEQ.IRDIS.NDIT.LIST    "5 5 5 5 5 5 5 5 5 5"
SEQ.READOUT.LIST       "Double"
INS.COMB.ICOR          "N_NS_CLEAR"
INS.COMB.IND           "ND_N_1.0"
INS.MODE               "IRDIFS_NIROBS"

SPHERE_IRDIFS_FLAT_IRDIS296_0001.fits
SPHERE_IRDIFS_FLAT_IRDIS296_0002.fits
SPHERE_IRDIFS_FLAT_IRDIS296_0003.fits
SPHERE_IRDIFS_FLAT_IFS296_0002.fits
SPHERE_IRDIFS_FLAT_IRDIS296_0004.fits
SPHERE_IRDIFS_FLAT_IRDIS296_0005.fits
SPHERE_IRDIFS_FLAT_IRDIS296_0006.fits
SPHERE_IRDIFS_FLAT_IRDIS296_0007.fits
SPHERE_IRDIFS_FLAT_IRDIS296_0008.fits
SPHERE_IRDIFS_FLAT_IRDIS296_0009.fits
```

SPHERE_IRDIFS_FLAT_IRDIS296_0010.fits
SPHERE_IRDIFS_FLAT_IFS296_0003.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdifs_cal_specpos"
DET.DIT "2"
DET.NDIT "1"
INS.MODE "IRDIFS_NIROBS"

SPHERE_IRDIFS_SPECPOS296_0001.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdifs_cal_ifsflat"
DET.DIT "2"
DET.NDIT "10"
INS.MODE "IRDIFS_NIROBS"

SPHERE_IRDIFS_FLAT296_0001.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdifs_cal_wave"
DET.DIT "2"
DET.NDIT "10"
INS.MODE "IRDIFS_NIROBS"

SPHERE_IRDIFS_WAVE296_0001.fits

18.11 **IRDIFS- NIROBS-acq+obs.obx**

```
ACQUISITION.TEMPLATE.NAME "SPHERE_irdifs_acq"
DET.IFS.DIT          "2"
DET.IFS.NDIT         "1"
SEQ.DO.CENTERING     "T"
SEQ.DO.FOCUS         "F"
SEQ.DTTS.BACKGND     "F"
SEQ.DTTS.DIT         "1"
SEQ.IFS.DETFF        "T"
SEQ.IR.GAIN          "0.4"
SEQ.PRESET           "T"
SEQ.PUP.GAIN         "0."
SEQ.TARGET.HMAG      "0"
SEQ.TARGET.RMAG      "0"
SEQ.VISHO.GAIN       "0"
SEQ.VISTT.GAIN       "0.05"
SEQ.VWFS.BACKGND     "F"
SEQ.VWFS.DIT         "1"
TEL.TARG.TYPE        "COORDINATE"
TEL.TARG.OFFSETALPHA "5"
TEL.TARG.OFFSETDELTA "5"
TEL.GS1.ALPHA        "0."
TEL.GS1.DELTA        "0."
TEL.GS1.MAG          "12."
INS.COMB.ICOR        "N_ALC_YJH_S"
INS.COMB.IFLT        "DB_NDH23"
INS.COMB.ROT         "PUPIL"
INS.CPRT.POSANG      "0.0"
INS.MODE             "IRDIFS_NIRSUR"

#
#
#
TEMPLATE.NAME "SPHERE_irdifs_obs_flux"
DET.IFS.DIT           "2"
DET.IRDIS.DIT         "0.84"
DET.IFS.NDIT          "5"
DET.IRDIS.NDIT        "5"
DET.IRDIS.READOUT     "Double"
SEQ.DET.TARG.OFFSETX   "300"
SEQ.DET.TARG.OFFSETY   "500"
INS.COMB.IFLT         "DB_H23"
INS.COMB.IND          "ND_N_3.5"
```

INS.COMB.ROT "PUPIL"
INS.CPRT.POSANG "0.0"
INS.MODE "IRDIFS_NIROBS"

SPHERE_IRDIFS_OBJ296_0007.fits
SPHERE_IRDIFS_OBJECT_IFS296_0001.fits
SPHERE_IRDIFS_OBJ296_0008.fits
SPHERE_IRDIFS_OBJECT_IFS296_0002.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdifs_obs_star_center"
DET.IFS.DIT "2"
DET.IRDIS.DIT "1.6"
DET.IFS.NDIT "5"
DET.IRDIS.NDIT "5"
DET.IRDIS.READOUT "Nondest"
SEQ.IFS.DITH.PATTERN "1x1"
SEQ.IFS.DITH.PATTERN.NB "1"
SEQ.IFS.NEXPO "1"
SEQ.WAFFLE.AMPLITUDE "0.015"
INS.COMB.IFLT "DB_H23"
INS.COMB.IND "ND_N_1.0"
INS.COMB.ROT "PUPIL"
INS.CPRT.POSANG "0.0"
INS.MODE "IRDIFS_NIROBS"

SPHERE_IRDIFS_OBJ296_0009.fits
SPHERE_IRDIFS_OBJECT_IFS296_0003.fits

#
#
#
TEMPLATE.NAME "SPHERE_irdifs_obs_exp_NIROBS"
DET.IFS.DIT "2"
DET.IRDIS.DIT "1.6"
DET.IFS.NDIT "50"
DET.IRDIS.NDIT "20"
DET.IRDIS.READOUT "Double"
SEQ.DITH.PATTERN "4x4"
SEQ.DITH.PATTERN.NB "1"
SEQ.DITH.STOP.POS "0"
SEQ.IFS.DITH.PATTERN "1x1"
SEQ.IFS.DITH.PATTERN.NB "1"
SEQ.IFS.NEXPO "10"

SEQ.NEXPO	"1"
SEQ.SWAP	"T"
INS.COMB.IFLT	"DB_H23"
INS.COMB.IND	"ND_N_1.0"
INS.COMB.ROT	"PUPIL"
INS.CPRT.POSANG	"0.0"

18.12 **ZIMPOL_FastPol_NR_calibrations.obx**

```
IMPEX.VERSION "2.0"
type                    "O"
STTimeIntervals         ""
calibrationReq          ""
InstrumentComments      ""
userComments            ""
userPriority            "1"
LineNumber              "0"
name                    "ZIMPOL_FastPol_NR_calibrations"


comments                ""
objectClass             ""
ra                      " 00:00:00.000"
dec                     " 00:00:00.000"
epoch                   "2000.0"
equinox                 "2000"
propDec                 "0.000000"
propRA                  "0.000000"
diffRA                  "0.000000"
diffDec                 "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"


air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                      "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"


longDescription             ""
IPVersion                   "10.3"
instrument                  "SPHERE"
LineNumber                  "0"
OBSERVATION.DESCRIPTION.NAME "No Name"
```

```
TEMPLATE.NAME "SPHERE_zimpol_cal_bias_pol"
DET.ZIMPOL.NDIT          "20"
DET.ZIMPOL.READOUT       "FastPolarimetry"
SEQ.NEXPO                "1"


TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT           "2"
DET.ZIMPOL.NDIT          "10"
DET.ZIMPOL.READOUT       "FastPolarimetry"
DET.ZIMPOL.SHUTTER       "Disabled"
SEQ.NEXPO                "1"
SEQ.ZIMPOL.FIELD.POS     "0"
INS.CBFW.NAME            "OPEN"
INS.VCW.NAME             "CLEAR1"
INS.ZIFW0.NAME           "OPEN"
INS.ZIFW1.NAME           "N_R"
INS.ZIFW2.NAME           "N_R"


TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT           "10"
DET.ZIMPOL.NDIT          "10"
DET.ZIMPOL.READOUT       "FastPolarimetry"
DET.ZIMPOL.SHUTTER       "Disabled"
SEQ.NEXPO                "1"
SEQ.ZIMPOL.FIELD.POS     "0"
INS.CBFW.NAME            "OPEN"
INS.VCW.NAME             "CLEAR1"
INS.ZIFW0.NAME           "OPEN"
INS.ZIFW1.NAME           "N_R"
INS.ZIFW2.NAME           "N_R"


TEMPLATE.NAME "SPHERE_zimpol_cal_modem_poleff"
DET.ZIMPOL.DIT           "10"
DET.ZIMPOL.NDIT          "2"
DET.ZIMPOL.READOUT       "FastPolarimetry"
DET.ZIMPOL.SHUTTER       "Disabled"
SEQ.NEXPO                "1"
SEQ.ZIMPOL.FIELD.POS     "0"
SEQ.ZIMPOL.ZHRT.SWITCH   "PLUS"
INS.CBFW.NAME            "OPEN"
INS.VCW.NAME             "CLEAR1"
INS.ZIFW1.NAME           "N_R"
INS.ZIFW2.NAME           "N_R"
```

18.13 **ZIMPOL_FastPol_ACQ+OBS_BSGREY_NR.obx**

```
IMPEX.VERSION "2.0"
type                    "O"
STTimeIntervals         ""
calibrationReq          ""
InstrumentComments      ""
userComments            ""
userPriority            "1"
LineNumber              "0"
name                    "ZIMPOL_FastPol_ACQ+OBS_BSGREY_NR"


comments                ""
objectClass             ""
ra                    " 00:00:00.000"
dec                    "-80:00:00.000"
epoch                   "2000.0"
equinox                 "2000"
propDec                 "0.000000"
propRA                  "0.000000"
diffRA                 "0.000000"
diffDec                "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"


air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                     "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"


longDescription             ""
IPVersion                  "10.3"
instrument                 "SPHERE"
LineNumber                  "0"
OBSERVATION.DESCRIPTION.NAME "No Name"
```

```
ACQUISITION.TEMPLATE.NAME "SPHERE_zimpol_acq"
DET.DIT             "1.3"
DET.NDIT            "2"
SEQ.CENTHRESHOLD    "0.2"
SEQ.DOCENTER        "T"
SEQ.DOFOCUS         "F"
SEQ.DTTS.DIT        "1"
SEQ.FOCUSRANGE      "2.0"
SEQ.GAIN            "0.5"
SEQ.IR.GAIN         "0.4"
SEQ.KX              "0.15"
SEQ.KY              "0.15"
SEQ.NBCENTER        "8"
SEQ.NBFOCUS         "5"
SEQ.PRESET          "T"
SEQ.PUP.GAIN        "0"
SEQ.TARGET.HMAG     "0"
SEQ.TARGET.RMAG     "3"
SEQ.USELYOT         "F"
SEQ.VISHO.GAIN      "0"
SEQ.VISTT.GAIN      "0.05"
SEQ.VWFS.BACKGND    "F"
SEQ.VWFS.DIT        "1"
SEQ.VWFS.READOUT    "GAIN_30_FREQ_1200Hz"
SEQ.WINSIZE         "100"
SEQ.Z4MAX           "2"
SEQ.Z4MIN           "-2"
TEL.TARG.TYPE       "COORDINATE"
TEL.TARG.OFFSETALPHA "5"
TEL.TARG.OFFSETDELTA "5"
TEL.GS1.ALPHA       "0."
TEL.GS1.DELTA       "-80:00:00.000"
TEL.GS1.MAG         "12."
INS.VCW.NAME        "CLC4"
INS.VLW.NAME        "OPEN"
INS.ZIFW0.NAME      "OPEN"
INS.ZIFW1.NAME      "N_R"
INS.ZIFW2.NAME      "N_R"
INS.ZISL.NAME       "BS_GREY"



TEMPLATE.NAME "SPHERE_zimpol_obs_exp_polp2p3"
DET.ZIMPOL.DIT              "1.1"
DET.ZIMPOL.NDIT             "20"
```

```
DET.ZIMPOL.READOUT          "FastPolarimetry"
DET.ZIMPOL.SHUTTER          "Disabled"
SEQ.NEXPO                   "1"
SEQ.ZIMPOL.DITH.PATTERN.LIST  "0 0"
SEQ.ZIMPOL.FIELD.ETA        "0.0"
SEQ.ZIMPOL.FIELD.POS        "0"
SEQ.ZIMPOL.POL.GAMMA        "0"
SEQ.ZIMPOL.POL.NPOL         "1"
SEQ.ZIMPOL.POL.PCOMLOOP     "0"
SEQ.ZIMPOL.POL.STOKES       "Q"
INS.MODE                    "ZIMPOL_P2"
INS.VCW.NAME                "CLC4"
INS.VLW.NAME                "STOPB1"
INS.ZCSL.NAME               "COMP"
INS.ZCTT.POS                "25.0"
INS.ZIFW0.NAME              "OPEN"
INS.ZIFW1.NAME              "N_R"
INS.ZIFW2.NAME              "N_R"


TEMPLATE.NAME "SPHERE_zimpol_obs_exp_polp2p3"
DET.ZIMPOL.DIT              "1.1"
DET.ZIMPOL.NDIT             "50"
DET.ZIMPOL.READOUT          "FastPolarimetry"
DET.ZIMPOL.SHUTTER          "Disabled"
SEQ.NEXPO                   "5"
SEQ.ZIMPOL.DITH.PATTERN.LIST  "0 0"
SEQ.ZIMPOL.FIELD.ETA        "0.0"
SEQ.ZIMPOL.FIELD.POS        "0"
SEQ.ZIMPOL.POL.GAMMA        "0"
SEQ.ZIMPOL.POL.NPOL         "2"
SEQ.ZIMPOL.POL.PCOMLOOP     "0"
SEQ.ZIMPOL.POL.STOKES       "Q"
INS.MODE                    "ZIMPOL_P2"
INS.VCW.NAME                "CLC4"
INS.VLW.NAME                "STOPB1"
INS.ZCSL.NAME               "COMP"
INS.ZCTT.POS                "25.0"
INS.ZIFW0.NAME              "OPEN"
INS.ZIFW1.NAME              "N_R"
INS.ZIFW2.NAME              "N_R"
```

18.14 **IRDIFS- IFS-H-calibrations.obx**

```
IMPEX.VERSION "2.0"
type                    "O"
STTimeIntervals         ""
calibrationReq          ""
InstrumentComments      ""
userComments            ""
userPriority            "1"
LineNumber              "0"
name                    "IRDIFS-ifs-H-calibrations"


comments                ""
objectClass             " Unknown           "
ra                    " 00:00:00.000"
dec                   " 00:00:00.000"
epoch                   "2000.0"
equinox                 "2000"
propDec                 "0.000000"
propRA                  "0.000000"
diffRA                  "0.000000"
diffDec                 "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"


air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                      "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"


longDescription             ""
IPVersion                   "10.3"
instrument                  "SPHERE"
LineNumber                  "0"
OBSERVATION.DESCRIPTION.NAME "No Name"


TEMPLATE.NAME "SPHERE_irdifs_cal_dark"
```

SEQ.IFS.DIT.LIST "2"
SEQ.IFS.NDIT.LIST "100"
SEQ.IRDIS.DIT.LIST "0.84 1.6"
SEQ.IRDIS.NDIT.LIST "50 50"
SEQ.READOUT.LIST "Double Double"

TEMPLATE.NAME "SPHERE_irdifs_cal_flat"
SEQ.COMB.CAL.LIST "FF_NIR_K_ND2.0"
SEQ.COMB.IFLT.LIST "DB_K12 DB_K12 DB_K12 DB_K12 DB_K12 DB_K12"
SEQ.COMB.IFS.LIST "CAL_BB_3_YJH CAL_BB_2_YJH"
SEQ.IFS.DIT.LIST "4 4"
SEQ.IFS.NDIT.LIST "20 20"
SEQ.IRDIS.DIT.LIST "2 3.2 4.4 5.6 6.8 8.0"
SEQ.IRDIS.NDIT.LIST "20 20 20 20 20 20"
SEQ.READOUT.LIST "Double"
INS.COMB.ICOR "N_NS_CLEAR"
INS.COMB.IND "ND_N_0.0"
INS.MODE "IRDIFS_IFS-H"

TEMPLATE.NAME "SPHERE_irdifs_cal_specpos"
DET.DIT "2"
DET.NDIT "1"
INS.MODE "IRDIFS_IFS-H"

TEMPLATE.NAME "SPHERE_irdifs_cal_ifsflat"
DET.DIT "2"
DET.NDIT "10"
INS.MODE "IRDIFS_IFS-H"

TEMPLATE.NAME "SPHERE_irdifs_cal_wave"
DET.DIT "2"
DET.NDIT "10"
INS.MODE "IRDIFS_IFS-H"

18.15 **IRDIFS-IFS-H-acq+obs.obx**

```
IMPEX.VERSION "2.0"
type                    "O"
STTimeIntervals         ""
calibrationReq          ""
InstrumentComments      ""
userComments            ""
userPriority            "1"
LineNumber              "0"
name                    "IRDIFS-IFS-H-acq+obs"


comments                ""
objectClass             " Unknown           "
ra                    " 00:00:00.000"
dec                    "-80:00:00.000"
epoch                   "2000.0"
equinox                 "2000"
propDec                 "0.000000"
propRA                  "0.000000"
diffRA                 "0.000000"
diffDec                "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"


air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                     "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"


longDescription             ""
IPVersion                  "10.3"
instrument                 "SPHERE"
LineNumber                  "0"
OBSERVATION.DESCRIPTION.NAME "No Name"
```

ACQUISITION.TEMPLATE.NAME "SPHERE_irdifs_acq"
DET.IFS.DIT "2"
DET.IFS.NDIT "1"
SEQ.DO.CENTERING "T"
SEQ.DO.FOCUS "F"
SEQ.DTTS.BACKGND "F"
SEQ.DTTS.DIT "1"
SEQ.IFS.DETFF "F"
SEQ.IR.GAIN "0.4"
SEQ.PRESET "T"
SEQ.PUP.GAIN "0."
SEQ.TARGET.HMAG "0"
SEQ.TARGET.RMAG "0"
SEQ.VISHO.GAIN "0"
SEQ.VISTT.GAIN "0.05"
SEQ.VWFS.BACKGND "F"
SEQ.VWFS.DIT "1"
TEL.TARG.TYPE "COORDINATE"
TEL.TARG.OFFSETALPHA "5"
TEL.TARG.OFFSETDELTA "5"
TEL.GS1.ALPHA "0."
TEL.GS1.DELTA " 00:00:00.000"
TEL.GS1.MAG "12."
INS.COMB.ICOR "N_ALC_YJH_S"
INS.COMB.IFLT "DB_K12"
INS.COMB.ROT "PUPIL"
INS.CPRT.POSANG "0.0"
INS.MODE "IRDIFS_IFS-H"

TEMPLATE.NAME "SPHERE_irdifs_obs_flux"
DET.IFS.DIT "2"
DET.IRDIS.DIT "0.84"
DET.IFS.NDIT "5"
DET.IRDIS.NDIT "5"
DET.IRDIS.READOUT "Double"
SEQ.DET.TARG.OFFSETX "300"
SEQ.DET.TARG.OFFSETY "500"
INS.COMB.IFLT "DB_K12"
INS.COMB.IND "ND_N_3.5"
INS.COMB.ROT "PUPIL"
INS.CPRT.POSANG "0.0"
INS.MODE "IRDIFS_IFS-H"

TEMPLATE.NAME "SPHERE_irdifs_obs_star_center"
DET.IFS.DIT "2"
DET.IRDIS.DIT "1.6"
DET.IFS.NDIT "5"
DET.IRDIS.NDIT "5"
DET.IRDIS.READOUT "Double"
SEQ.IFS.DITH.PATTERN "1x1"
SEQ.IFS.DITH.PATTERN.NB "1"
SEQ.IFS.NEXPO "1"
SEQ.WAFFLE.AMPLITUDE "0.012"
INS.COMB.IFLT "DB_K12"
INS.COMB.IND "ND_N_1.0"
INS.COMB.ROT "PUPIL"
INS.CPRT.POSANG "0.0"
INS.MODE "IRDIFS_IFS-H"

TEMPLATE.NAME "SPHERE_irdifs_obs_exp_IFS-H"
DET.IFS.DIT "2"
DET.IRDIS.DIT "10"
DET.IFS.NDIT "50"
DET.IRDIS.NDIT "6"
DET.IRDIS.READOUT "Double"
SEQ.DITH.PATTERN "4x4"
SEQ.DITH.PATTERN.NB "1"
SEQ.DITH.STOP.POS "0"
SEQ.IFS.DITH.PATTERN "1x1"
SEQ.IFS.DITH.PATTERN.NB "1"
SEQ.IFS.NEXPO "10"
SEQ.NEXPO "1"
INS.COMB.IND "ND_N_1.0"
INS.COMB.ROT "PUPIL"
INS.CPRT.POSANG "0.0"

18.16 **ZIMPOL_Imaging_clc3_BSGREY.obx**

IMPEX.VERSION "2.0"
type "O"
STTimeIntervals ""
calibrationReq ""
InstrumentComments ""
userComments ""
userPriority "1"
LineNumber "0"

name "ZIMPOL_Imaging_clc3_BSGREY"

comments ""
objectClass " Unknown "
ra " 00:00:00.000"
dec "-80:00:00.000"
epoch "2000.0"
equinox "2000"
propDec "0.000000"
propRA "0.000000"
diffRA "0.000000"
diffDec "0.000000"
LineNumber "0"
TARGET.NAME "No Name"

air_mass "5.0"
fractional_lunar_illumination "1.0"
sky_transparency "Photometric"
moon_angular_distance "30"
seeing "2.0"
StrehlRatio "0.0"
CONSTRAINT.SET.NAME "No Name"

longDescription ""
IPVersion "10.3"
instrument "SPHERE"
LineNumber "0"
OBSERVATION.DESCRIPTION.NAME "No Name"

ACQUISITION.TEMPLATE.NAME "SPHERE_zimpol_acq"
DET.DIT "1.3"
DET.NDIT "2"
SEQ.CENTHRESHOLD "0.2"
SEQ.DOCENTER "T"
SEQ.DOFOCUS "F"
SEQ.DTTS.DIT "1"
SEQ.FOCUSRANGE "2.0"
SEQ.GAIN "0.5"
SEQ.IR.GAIN "0.4"
SEQ.KX "0.15"
SEQ.KY "0.15"
SEQ.NBCENTER "8"

SEQ.NBFOCUS "5"
SEQ.PRESET "T"
SEQ.PUP.GAIN "0"
SEQ.TARGET.HMAG "0"
SEQ.TARGET.RMAG "3"
SEQ.USELYOT "F"
SEQ.VISHO.GAIN "0"
SEQ.VISTT.GAIN "0.05"
SEQ.VWFS.BACKGND "F"
SEQ.VWFS.DIT "1"
SEQ.VWFS.READOUT "GAIN_30_FREQ_1200Hz"
SEQ.WINSIZE "100"
SEQ.Z4MAX "2"
SEQ.Z4MIN "-2"
TEL.TARG.TYPE "COORDINATE"
TEL.TARG.OFFSETALPHA "5"
TEL.TARG.OFFSETDELTA "5"
TEL.GS1.ALPHA "0."
TEL.GS1.DELTA "-80:00:00.000"
TEL.GS1.MAG "12."
INS.VCW.NAME "CLC3"
INS.VLW.NAME "OPEN"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "N_R"
INS.ZIFW2.NAME "N_R"
INS.ZISL.NAME "DIC_HA"

TEMPLATE.NAME "SPHERE_zimpol_obs_exp_img"
DET.ZIMPOL.DIT "10"
DET.ZIMPOL.NDIT "1"
DET.ZIMPOL.READOUT "StandardImaging"
DET.ZIMPOL.SHUTTER "Disabled"
SEQ.NEXPO "1"
SEQ.ZIMPOL.DITH.PATTERN.LIST "0 0"
SEQ.ZIMPOL.FIELD.ETA "0.0"
SEQ.ZIMPOL.FIELD.POS "0"
INS.CPRT.MODE "SKY"
INS.VCW.NAME "CLC3"
INS.VLW.NAME "STOPB1"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "N_R"
INS.ZIFW2.NAME "N_R"

TEMPLATE.NAME "SPHERE_zimpol_obs_exp_img"
DET.ZIMPOL.DIT "20"
DET.ZIMPOL.NDIT "1"
DET.ZIMPOL.READOUT "StandardImaging"
DET.ZIMPOL.SHUTTER "Disabled"
SEQ.NEXPO "1"
SEQ.ZIMPOL.DITH.PATTERN.LIST "0 0"
SEQ.ZIMPOL.FIELD.ETA "0.0"
SEQ.ZIMPOL.FIELD.POS "0"
INS.CPRT.MODE "SKY"
INS.VCW.NAME "CLC3"
INS.VLW.NAME "STOPB1"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "B_Ha"
INS.ZIFW2.NAME "CntHa"

18.17 **ZIMPOL_FastPol_ACQ_4QPM2.obx**

IMPEX.VERSION "2.0"
type "O"
STTimeIntervals ""
calibrationReq ""
InstrumentComments ""
userComments ""
userPriority "1"
LineNumber "0"
name "ZIMPOL_FastPol_ACQ_4QPM2"

comments ""
objectClass " Unknown "
ra " 00:00:00.000"
dec "-80:00:00.000"
epoch "2000.0"
equinox "2000"
propDec "0.000000"
propRA "0.000000"
diffRA "0.000000"
diffDec "0.000000"
LineNumber "0"
TARGET.NAME "No Name"

air_mass "5.0"
fractional_lunar_illumination "1.0"

sky_transparency "Photometric"
moon_angular_distance "30"
seeing "2.0"
StrehlRatio "0.0"
CONSTRAINT.SET.NAME "No Name"

longDescription ""
IPVersion "10.3"
instrument "SPHERE"
LineNumber "0"
OBSERVATION.DESCRIPTION.NAME "No Name"

ACQUISITION.TEMPLATE.NAME "SPHERE_zimpol_acq"
DET.DIT "1.3"
DET.NDIT "2"
SEQ.CENTHRESHOLD "0.2"
SEQ.DOCENTER "T"
SEQ.DOFOCUS "F"
SEQ.DTTS.DIT "1"
SEQ.FOCUSRANGE "2.0"
SEQ.GAIN "0.5"
SEQ.IR.GAIN "0.4"
SEQ.KX "0.15"
SEQ.KY "0.15"
SEQ.NBCENTER "8"
SEQ.NBFOCUS "5"
SEQ.PRESET "T"
SEQ.PUP.GAIN "0"
SEQ.TARGET.HMAG "0"
SEQ.TARGET.RMAG "3"
SEQ.USELYOT "F"
SEQ.VISHO.GAIN "0"
SEQ.VISTT.GAIN "0.05"
SEQ.VWFS.BACKGND "F"
SEQ.VWFS.DIT "1"
SEQ.VWFS.READOUT "GAIN_30_FREQ_1200Hz"
SEQ.WINSIZE "100"
SEQ.Z4MAX "2"
SEQ.Z4MIN "-2"
TEL.TARG.TYPE "COORDINATE"
TEL.TARG.OFFSETALPHA "5"
TEL.TARG.OFFSETDELTA "5"
TEL.GS1.ALPHA "0."
TEL.GS1.DELTA "-80:00:00.000"

TEL.GS1.MAG "12."
INS.VCW.NAME "4QPM2"
INS.VLW.NAME "OPEN"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "N_I"
INS.ZIFW2.NAME "N_I"
INS.ZISL.NAME "BS_GREY"

TEMPLATE.NAME "SPHERE_zimpol_obs_exp_polp2p3"
DET.ZIMPOL.DIT "1.1"
DET.ZIMPOL.NDIT "20"
DET.ZIMPOL.READOUT "FastPolarimetry"
DET.ZIMPOL.SHUTTER "Disabled"
SEQ.NEXPO "1"
SEQ.ZIMPOL.DITH.PATTERN.LIST "0 0"
SEQ.ZIMPOL.FIELD.ETA "0.0"
SEQ.ZIMPOL.FIELD.POS "0"
SEQ.ZIMPOL.POL.GAMMA "0"
SEQ.ZIMPOL.POL.NPOL "1"
SEQ.ZIMPOL.POL.PCOMLOOP "0"
SEQ.ZIMPOL.POL.STOKES "Q"
INS.MODE "ZIMPOL_P2"
INS.VCW.NAME "4QPM2"
INS.VLW.NAME "STOPB3"
INS.ZCSL.NAME "COMP"
INS.ZCTT.POS "25.0"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "N_I"
INS.ZIFW2.NAME "N_I"

18.18 **ZIMPOL_SlowPol_NR_calibration.obx**

IMPEX.VERSION "2.0"
type "O"
STTimeIntervals ""
calibrationReq ""
InstrumentComments ""
userComments ""
userPriority "1"
LineNumber "0"
name "ZIMPOL_SlowPol_NR_calibration"

```
comments                ""
objectClass             " Unknown           "
ra                    " 00:00:00.000"
dec                    " 00:00:00.000"
epoch                  "2000.0"
equinox                "2000"
propDec                "0.000000"
propRA                 "0.000000"
diffRA                "0.000000"
diffDec               "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"


air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                     "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"


longDescription             ""
IPVersion                  "10.3"
instrument                 "SPHERE"
LineNumber                  "0"
OBSERVATION.DESCRIPTION.NAME "No Name"


TEMPLATE.NAME "SPHERE_zimpol_cal_bias_pol"
DET.ZIMPOL.NDIT           "20"
DET.ZIMPOL.READOUT        "SlowPolarimetry"
SEQ.NEXPO                 "1"


TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT            "10"
DET.ZIMPOL.NDIT           "10"
DET.ZIMPOL.READOUT        "SlowPolarimetry"
DET.ZIMPOL.SHUTTER        "Disabled"
SEQ.NEXPO                 "1"
SEQ.ZIMPOL.FIELD.POS      "0"
INS.CBFW.NAME             "OPEN"
INS.VCW.NAME              "CLEAR1"
INS.ZIFW0.NAME            "OPEN"
```

INS.ZIFW1.NAME "B_Ha"
INS.ZIFW2.NAME "B_Ha"

TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT "20"
DET.ZIMPOL.NDIT "10"
DET.ZIMPOL.READOUT "SlowPolarimetry"
DET.ZIMPOL.SHUTTER "Disabled"
SEQ.NEXPO "1"
SEQ.ZIMPOL.FIELD.POS "0"
INS.CBFW.NAME "OPEN"
INS.VCW.NAME "CLEAR1"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "B_Ha"
INS.ZIFW2.NAME "B_Ha"

TEMPLATE.NAME "SPHERE_zimpol_cal_modem_poleff"
DET.ZIMPOL.DIT "10"
DET.ZIMPOL.NDIT "2"
DET.ZIMPOL.READOUT "SlowPolarimetry"
DET.ZIMPOL.SHUTTER "Disabled"
SEQ.NEXPO "1"
SEQ.ZIMPOL.FIELD.POS "0"
SEQ.ZIMPOL.ZHRT.SWITCH "PLUS"
INS.CBFW.NAME "OPEN"
INS.VCW.NAME "CLEAR1"
INS.ZIFW1.NAME "B_Ha"
INS.ZIFW2.NAME "B_Ha"

18.19 **ZIMPOL_SlowPol_NR_calibration.obx**

IMPEX.VERSION "2.0"
type "O"
STTimeIntervals ""
calibrationReq ""
InstrumentComments ""
userComments ""
userPriority "1"
LineNumber "0"
name "ZIMPOL_SlowPol_NR_calibration"

comments ""

objectClass " Unknown "
ra " 00:00:00.000"
dec " 00:00:00.000"
epoch "2000.0"
equinox "2000"
propDec "0.000000"
propRA "0.000000"
diffRA "0.000000"
diffDec "0.000000"
LineNumber "0"
TARGET.NAME "No Name"

air_mass "5.0"
fractional_lunar_illumination "1.0"
sky_transparency "Photometric"
moon_angular_distance "30"
seeing "2.0"
StrehlRatio "0.0"
CONSTRAINT.SET.NAME "No Name"

longDescription ""
IPVersion "10.3"
instrument "SPHERE"
LineNumber "0"
OBSERVATION.DESCRIPTION.NAME "No Name"

TEMPLATE.NAME "SPHERE_zimpol_cal_bias_pol"
DET.ZIMPOL.NDIT "20"
DET.ZIMPOL.READOUT "SlowPolarimetry"
SEQ.NEXPO "1"

TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT "10"
DET.ZIMPOL.NDIT "10"
DET.ZIMPOL.READOUT "SlowPolarimetry"
DET.ZIMPOL.SHUTTER "Disabled"
SEQ.NEXPO "1"
SEQ.ZIMPOL.FIELD.POS "0"
INS.CBFW.NAME "OPEN"
INS.VCW.NAME "CLEAR1"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "B_Ha"

INS.ZIFW2.NAME "B_Ha"

TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT "20"
DET.ZIMPOL.NDIT "10"
DET.ZIMPOL.READOUT "SlowPolarimetry"
DET.ZIMPOL.SHUTTER "Disabled"
SEQ.NEXPO "1"
SEQ.ZIMPOL.FIELD.POS "0"
INS.CBFW.NAME "OPEN"
INS.VCW.NAME "CLEAR1"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "B_Ha"
INS.ZIFW2.NAME "B_Ha"

TEMPLATE.NAME "SPHERE_zimpol_cal_modem_poleff"
DET.ZIMPOL.DIT "10"
DET.ZIMPOL.NDIT "2"
DET.ZIMPOL.READOUT "SlowPolarimetry"
DET.ZIMPOL.SHUTTER "Disabled"
SEQ.NEXPO "1"
SEQ.ZIMPOL.FIELD.POS "0"
SEQ.ZIMPOL.ZHRT.SWITCH "PLUS"
INS.CBFW.NAME "OPEN"
INS.VCW.NAME "CLEAR1"
INS.ZIFW1.NAME "B_Ha"
INS.ZIFW2.NAME "B_Ha"

18.20 **ZIMPOL_SlowPol_Ha_calibration.obx**

IMPEX.VERSION "2.0"
type "O"
STTimeIntervals ""
calibrationReq ""
InstrumentComments ""
userComments ""
userPriority "1"
LineNumber "0"
name "ZIMPOL_SlowPol_Ha_calibration"

comments ""
objectClass " Unknown "

ra " 00:00:00.000"
dec " 00:00:00.000"
epoch "2000.0"
equinox "2000"
propDec "0.000000"
propRA "0.000000"
diffRA "0.000000"
diffDec "0.000000"
LineNumber "0"
TARGET.NAME "No Name"

air_mass "5.0"
fractional_lunar_illumination "1.0"
sky_transparency "Photometric"
moon_angular_distance "30"
seeing "2.0"
StrehlRatio "0.0"
CONSTRAINT.SET.NAME "No Name"

longDescription ""
IPVersion "10.3"
instrument "SPHERE"
LineNumber "0"
OBSERVATION.DESCRIPTION.NAME "No Name"

TEMPLATE.NAME "SPHERE_zimpol_cal_bias_pol"
DET.ZIMPOL.NDIT "20"
DET.ZIMPOL.READOUT "SlowPolarimetry"
SEQ.NEXPO "1"

TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT "10"
DET.ZIMPOL.NDIT "10"
DET.ZIMPOL.READOUT "SlowPolarimetry"
DET.ZIMPOL.SHUTTER "Disabled"
SEQ.NEXPO "1"
SEQ.ZIMPOL.FIELD.POS "0"
INS.CBFW.NAME "OPEN"
INS.VCW.NAME "CLEAR1"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "B_Ha"
INS.ZIFW2.NAME "B_Ha"

```
TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT            "20"
DET.ZIMPOL.NDIT           "10"
DET.ZIMPOL.READOUT        "SlowPolarimetry"
DET.ZIMPOL.SHUTTER        "Disabled"
SEQ.NEXPO                 "1"
SEQ.ZIMPOL.FIELD.POS      "0"
INS.CBFW.NAME             "OPEN"
INS.VCW.NAME              "CLEAR1"
INS.ZIFW0.NAME            "OPEN"
INS.ZIFW1.NAME            "B_Ha"
INS.ZIFW2.NAME            "B_Ha"


TEMPLATE.NAME "SPHERE_zimpol_cal_modem_poleff"
DET.ZIMPOL.DIT              "10"
DET.ZIMPOL.NDIT             "2"
DET.ZIMPOL.READOUT          "SlowPolarimetry"
DET.ZIMPOL.SHUTTER          "Disabled"
SEQ.NEXPO                   "1"
SEQ.ZIMPOL.FIELD.POS        "0"
SEQ.ZIMPOL.ZHRT.SWITCH      "PLUS"
INS.CBFW.NAME               "OPEN"
INS.VCW.NAME                "CLEAR1"
INS.ZIFW1.NAME              "B_Ha"
INS.ZIFW2.NAME              "B_Ha"
```

18.21 **ZIMPOL_SlowPol_ACQ+OBS_BSGREY.obx**

```
IMPEX.VERSION "2.0"
type                "O"
STTimeIntervals     ""
calibrationReq      ""
InstrumentComments  ""
userComments        ""
userPriority        "1"
LineNumber          "0"
name                "ZIMPOL_SlowPol_ACQ+OBS_BSGREY"


comments            ""
objectClass         " Unknown          "
ra                  " 00:00:00.000"
```

dec "-80:00:00.000"
epoch "2000.0"
equinox "2000"
propDec "0.000000"
propRA "0.000000"
diffRA "0.000000"
diffDec "0.000000"
LineNumber "0"
TARGET.NAME "No Name"

air_mass "5.0"
fractional_lunar_illumination "1.0"
sky_transparency "Photometric"
moon_angular_distance "30"
seeing "2.0"
StrehlRatio "0.0"
CONSTRAINT.SET.NAME "No Name"

longDescription ""
IPVersion "10.3"
instrument "SPHERE"
LineNumber "0"
OBSERVATION.DESCRIPTION.NAME "No Name"

ACQUISITION.TEMPLATE.NAME "SPHERE_zimpol_acq"
DET.DIT "1.3"
DET.NDIT "2"
SEQ.CENTHRESHOLD "0.2"
SEQ.DOCENTER "T"
SEQ.DOFOCUS "F"
SEQ.DTTS.DIT "1"
SEQ.FOCUSRANGE "2.0"
SEQ.GAIN "0.5"
SEQ.IR.GAIN "0.4"
SEQ.KX "0.15"
SEQ.KY "0.15"
SEQ.NBCENTER "8"
SEQ.NBFOCUS "5"
SEQ.PRESET "T"
SEQ.PUP.GAIN "0"
SEQ.TARGET.HMAG "0"
SEQ.TARGET.RMAG "3"
SEQ.USELYOT "F"

SEQ.VISHO.GAIN "0"
SEQ.VISTT.GAIN "0.05"
SEQ.VWFS.BACKGND "F"
SEQ.VWFS.DIT "1"
SEQ.VWFS.READOUT "GAIN_30_FREQ_1200Hz"
SEQ.WINSIZE "100"
SEQ.Z4MAX "2"
SEQ.Z4MIN "-2"
TEL.TARG.TYPE "COORDINATE"
TEL.TARG.OFFSETALPHA "5"
TEL.TARG.OFFSETDELTA "5"
TEL.GS1.ALPHA "0."
TEL.GS1.DELTA "-80:00:00.000"
TEL.GS1.MAG "12."
INS.VCW.NAME "CLC4"
INS.VLW.NAME "OPEN"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "N_R"
INS.ZIFW2.NAME "N_R"
INS.ZISL.NAME "BS_GREY"

TEMPLATE.NAME "SPHERE_zimpol_obs_exp_polp2p3"
DET.ZIMPOL.DIT "10"
DET.ZIMPOL.NDIT "20"
DET.ZIMPOL.READOUT "SlowPolarimetry"
DET.ZIMPOL.SHUTTER "Disabled"
SEQ.NEXPO "1"
SEQ.ZIMPOL.DITH.PATTERN.LIST "0 0"
SEQ.ZIMPOL.FIELD.ETA "0.0"
SEQ.ZIMPOL.FIELD.POS "0"
SEQ.ZIMPOL.POL.GAMMA "0"
SEQ.ZIMPOL.POL.NPOL "1"
SEQ.ZIMPOL.POL.PCOMLOOP "0"
SEQ.ZIMPOL.POL.STOKES "Q"
INS.MODE "ZIMPOL_P2"
INS.VCW.NAME "CLC4"
INS.VLW.NAME "STOPB1"
INS.ZCSL.NAME "COMP"
INS.ZCTT.POS "25.0"
INS.ZIFW0.NAME "OPEN"
INS.ZIFW1.NAME "B_Ha"
INS.ZIFW2.NAME "B_Ha"

18.22 **ZIMPOL_Imaging_NRHa_calibration.obx**

```
IMPEX.VERSION "2.0"
type                    "O"
STTimeIntervals         ""
calibrationReq          ""
InstrumentComments      ""
userComments            ""
userPriority            "1"
LineNumber              "0"
name                    "ZIMPOL_Imaging_NRHa_calibration"


comments                ""
objectClass             " Unknown           "
ra                    " 00:00:00.000"
dec                   " 00:00:00.000"
epoch                   "2000.0"
equinox                 "2000"
propDec                 "0.000000"
propRA                  "0.000000"
diffRA                  "0.000000"
diffDec                 "0.000000"
LineNumber              "0"
TARGET.NAME             "No Name"


air_mass                    "5.0"
fractional_lunar_illumination "1.0"
sky_transparency            "Photometric"
moon_angular_distance       "30"
seeing                      "2.0"
StrehlRatio                 "0.0"
CONSTRAINT.SET.NAME         "No Name"


longDescription             ""
IPVersion                   "10.3"
instrument                  "SPHERE"
LineNumber                  "0"
OBSERVATION.DESCRIPTION.NAME "No Name"


TEMPLATE.NAME "SPHERE_zimpol_cal_bias_pol"
DET.ZIMPOL.NDIT           "20"
DET.ZIMPOL.READOUT        "StandardImaging"
SEQ.NEXPO                 "1"
```

```
TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT            "2"
DET.ZIMPOL.NDIT           "10"
DET.ZIMPOL.READOUT        "StandardImaging"
DET.ZIMPOL.SHUTTER        "Disabled"
SEQ.NEXPO                 "5"
SEQ.ZIMPOL.FIELD.POS      "0"
INS.CBFW.NAME             "OPEN"
INS.VCW.NAME              "CLEAR1"
INS.ZIFW0.NAME            "OPEN"
INS.ZIFW1.NAME            "N_R"
INS.ZIFW2.NAME            "N_R"

TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT            "10"
DET.ZIMPOL.NDIT           "10"
DET.ZIMPOL.READOUT        "StandardImaging"
DET.ZIMPOL.SHUTTER        "Disabled"
SEQ.NEXPO                 "5"
SEQ.ZIMPOL.FIELD.POS      "0"
INS.CBFW.NAME             "OPEN"
INS.VCW.NAME              "CLEAR1"
INS.ZIFW0.NAME            "OPEN"
INS.ZIFW1.NAME            "N_R"
INS.ZIFW2.NAME            "N_R"

TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT            "10"
DET.ZIMPOL.NDIT           "10"
DET.ZIMPOL.READOUT        "StandardImaging"
DET.ZIMPOL.SHUTTER        "Disabled"
SEQ.NEXPO                 "5"
SEQ.ZIMPOL.FIELD.POS      "0"
INS.CBFW.NAME             "OPEN"
INS.VCW.NAME              "CLEAR1"
INS.ZIFW0.NAME            "OPEN"
INS.ZIFW1.NAME            "B_Ha"
INS.ZIFW2.NAME            "CntHa"

TEMPLATE.NAME "SPHERE_zimpol_cal_flat_pol"
DET.ZIMPOL.DIT            "30"
```

```
DET.ZIMPOL.NDIT          "10"
DET.ZIMPOL.READOUT       "StandardImaging"
DET.ZIMPOL.SHUTTER       "Disabled"
SEQ.NEXPO                "5"
SEQ.ZIMPOL.FIELD.POS     "0"
INS.CBFW.NAME            "OPEN"
INS.VCW.NAME             "CLEAR1"
INS.ZIFW0.NAME           "OPEN"
INS.ZIFW1.NAME           "B_Ha"
INS.ZIFW2.NAME           "CntHa"
```

19 Appendix B Pipeline Scripts

19.1 IFS

19.1.1 SOF files

dark.sof ==> Input for sph_ifs_master_dark
./IFS_24oct13/dark/data/SPHERE_IRDIFS_DARK_IFS296_0001.fits
IFS_DARK_RAW

---

flat.sof ==> Input for sph_ifs_master_detector_flat
./IFS_24oct13/flat/data/SPHERE_IRDIFS_FLAT_IFS293_0001.fits
IFS_DETECTOR_FLAT_FIELD_RAW
./IFS_24oct13/flat/data/SPHERE_IRDIFS_FLAT_IFS293_0002.fits
IFS_DETECTOR_FLAT_FIELD_RAW
./IFS_24oct13/dark/master_dark.fits
IFS_MASTER_DARK
./IFS_24oct13/dark/static_badpixels.fits
IFS_STATIC_BADPIXELMAP

---

specpos.sof ==> Input for sph_ifs_spectra_positions
./IFS_24oct13/specpos/data/SPHERE_IRDIFS_SPECPOS296_0001.fits
IFS_SPECPOS_RAW
./IFS_24oct13/dark/master_dark.fits
IFS_MASTER_DARK

---

wavecal.sof ==> Input for sph_ifs_wave_calib
./IFS_24oct13/wave/data/SPHERE_IRDIFS_WAVE296_0001.fits
IFS_WAVECALIB_RAW
./IFS_24oct13/specpos/spectra_positions.fits
IFS_SPECPOS

---

instflat.sof ==> Input for sph_ifs_instrument_flat
./IFS_24oct13/ifsflat/data/SPHERE_IRDIFS_FLAT296_0001.fits
IFS_FLAT_FIELD_RAW
./IFS_24oct13/wave/pdt_wave_calib.fits
IFS_WAVECALIB
./IFS_24oct13/flat/master_detector_flat_1020.fits
IFS_MASTER_DFF_LONG1
./IFS_24oct13/flat/master_detector_flat_1230.fits
IFS_MASTER_DFF_LONG2
./IFS_24oct13/flat/master_detector_flat_1300.fits

IFS_MASTER_DFF_LONG3
./IFS_24oct13/flat/master_detector_flat_white.fits
IFS_MASTER_DFF_LONGBB
./IFS_24oct13/flat/master_detector_flat_white.fits
IFS_MASTER_DFF_SHORT
./IFS_24oct13/flat/preamp_flat_white.fits
IFS_PREAMP_FLAT
./IFS_24oct13/dark/master_dark.fits
IFS_MASTER_DARK

---

science.sof ==> Input for sph_ifs_science_dr (science data)
./IFS_24oct13/science/data/SPHERE_IRDIFS_OBJECT_IFS296_0005.fits
IFS_SCIENCE_DR_RAW
./IFS_24oct13/flat/master_detector_flat_1020.fits
IFS_MASTER_DFF_LONG1
./IFS_24oct13/flat/master_detector_flat_1230.fits
IFS_MASTER_DFF_LONG2
./IFS_24oct13/flat/master_detector_flat_1300.fits
IFS_MASTER_DFF_LONG3
./IFS_24oct13/flat/master_detector_flat_white.fits
IFS_MASTER_DFF_LONGBB
./IFS_24oct13/flat/master_detector_flat_white.fits
IFS_MASTER_DFF_SHORT
./IFS_24oct13/flat/preamp_flat_white.fits
IFS_PREAMP_FLAT
./IFS_24oct13/wave/pdt_wave_calib.fits
IFS_WAVECALIB
./IFS_24oct13/ifsflat/ifs_ifu_flat.fits
IFS_IFU_FLAT_FIELD
./IFS_24oct13/dark/static_badpixels.fits
IFS_STATIC_BADPIXELMAP
./IFS_24oct13/dark/master_dark.fits
IFS_MASTER_DARK

---

flux.sof ==> Input for sph_ifs_science_dr (flux normalization data)
./IFS_24oct13/science/data/SPHERE_IRDIFS_OBJECT_IFS296_0002.fits
IFS_SCIENCE_DR_RAW
./IFS_24oct13/flat/master_detector_flat_1020.fits
IFS_MASTER_DFF_LONG1
./IFS_24oct13/flat/master_detector_flat_1230.fits
IFS_MASTER_DFF_LONG2
./IFS_24oct13/flat/master_detector_flat_1300.fits
IFS_MASTER_DFF_LONG3
./IFS_24oct13/flat/master_detector_flat_white.fits

IFS_MASTER_DFF_LONGBB
./IFS_24oct13/flat/master_detector_flat_white.fits
IFS_MASTER_DFF_SHORT
./IFS_24oct13/flat/preamp_flat_white.fits
IFS_PREAMP_FLAT
./IFS_24oct13/wave/pdt_wave_calib.fits
IFS_WAVECALIB
./IFS_24oct13/ifsflat/ifs_ifu_flat.fits
IFS_IFU_FLAT_FIELD
./IFS_24oct13/dark/static_badpixels.fits
IFS_STATIC_BADPIXELMAP
./IFS_24oct13/dark/master_dark.fits
IFS_MASTER_DARK

---

starcenter.sof ==> Input for sph_ifs_science_dr (waffles data)
./IFS_24oct13/science/data/SPHERE_IRDIFS_OBJECT_IFS296_0003.fits
IFS_SCIENCE_DR_RAW
./IFS_24oct13/flat/master_detector_flat_1020.fits
IFS_MASTER_DFF_LONG1
./IFS_24oct13/flat/master_detector_flat_1230.fits
IFS_MASTER_DFF_LONG2
./IFS_24oct13/flat/master_detector_flat_1300.fits
IFS_MASTER_DFF_LONG3
./IFS_24oct13/flat/master_detector_flat_white.fits
IFS_MASTER_DFF_LONGBB
./IFS_24oct13/flat/master_detector_flat_white.fits
IFS_MASTER_DFF_SHORT
./IFS_24oct13/flat/preamp_flat_white.fits
IFS_PREAMP_FLAT
./IFS_24oct13/wave/pdt_wave_calib.fits
IFS_WAVECALIB
./IFS_24oct13/ifsflat/ifs_ifu_flat.fits
IFS_IFU_FLAT_FIELD
./IFS_24oct13/dark/static_badpixels.fits
IFS_STATIC_BADPIXELMAP
./IFS_24oct13/dark/master_dark.fits
IFS_MASTER_DARK

19.1.2 Esorex commands

esorex sph_ifs_master_dark --
ifs.master_dark.outfilename=./PAE/IFS_24oct13/dark/master_dark.fits --
ifs.master_dark.badpixfilename=./PAE/IFS_24oct13/dark/static_badpixels.fits
/data/work/PAE/IFS_24oct13/dark/dark.sof

esorex sph_ifs_master_detector_flat --
ifs.master_detector_flat.outfilename=./PAE/IFS_24oct13/flat/master_detector_flat_white.fits --
ifs.master_detector_flat.lss_outfilename=./PAE/IFS_24oct13/flat/large_scale_flat_white.fits --
ifs.master_detector_flat.preamp_outfilename=./PAE/IFS_24oct13/flat/preamp_flat_white.fits --
ifs.master_detector_flat.badpixfilename=./PAE/IFS_24oct13/flat/dff_badpixelname_white.fits --ifs.master_detector_flat.lambda=-1.0
/data/work/PAE/IFS_24oct13/flat/flat.sof

esorex sph_ifs_master_detector_flat --
ifs.master_detector_flat.outfilename=./PAE/IFS_24oct13/flat/master_detector_flat_1020.fits --
ifs.master_detector_flat.lss_outfilename=./PAE/IFS_24oct13/flat/large_scale_flat_1020.fits --
ifs.master_detector_flat.preamp_outfilename=./PAE/IFS_24oct13/flat/preamp_flat_1020.fits --
ifs.master_detector_flat.badpixfilename=./PAE/IFS_24oct13/flat/dff_badpixelname_1020.fits --ifs.master_detector_flat.lambda=1.020
/data/work/PAE/IFS_24oct13/flat/flat.sof

esorex sph_ifs_master_detector_flat --
ifs.master_detector_flat.outfilename=./PAE/IFS_24oct13/flat/master_detector_flat_1230.fits --
ifs.master_detector_flat.lss_outfilename=./PAE/IFS_24oct13/flat/large_scale_flat_1230.fits --
ifs.master_detector_flat.preamp_outfilename=./PAE/IFS_24oct13/flat/preamp_flat_1230.fits --
ifs.master_detector_flat.badpixfilename=./PAE/IFS_24oct13/flat/dff_badpixelname_1230.fits --ifs.master_detector_flat.lambda=1.230
/data/work/PAE/IFS_24oct13/flat/flat.sof

esorex sph_ifs_master_detector_flat --
ifs.master_detector_flat.outfilename=./PAE/IFS_24oct13/flat/master_detector_flat_1300.fits --
ifs.master_detector_flat.lss_outfilename=./PAE/IFS_24oct13/flat/large_scale_flat_1300.fits --
ifs.master_detector_flat.preamp_outfilename=./PAE/IFS_24oct13/flat/preamp_flat_1

```
300.fits --
ifs.master_detector_flat.badpixfilename=./PAE/IFS_24oct13/flat/dff_badpixelname_w
hite.fits --ifs.master_detector_flat.lambda=1.300
/data/work/PAE/IFS_24oct13/flat/flat.sof

esorex sph_ifs_spectra_positions --
ifs.spectra_positions.outfilename=./PAE/IFS_24oct13/specpos/spectra_positions.fits
--ifs.spectra_positions.hmode=FALSE
/data/work/PAE/IFS_24oct13/specpos/specpos.sof

esorex sph_ifs_wave_calib --
ifs.wave_calib.outfilename=./PAE/IFS_24oct13/wave/pdt_wave_calib.fits
/data/work/PAE/IFS_24oct13/wave/wavecal.sof

esorex sph_ifs_instrument_flat --
ifs.instrument_flat.ifu_filename=./PAE/IFS_24oct13/ifsflat/ifs_ifu_flat.fits --
ifs.instrument_flat.nofit=TRUE /data/work/PAE/IFS_24oct13/ifsflat/instflat.sof

esorex sph_ifs_science_dr --
ifs.science_dr.outfilename=./PAE/IFS_24oct13/science/ifs_science_dr.fits
/data/work/PAE/IFS_24oct13/science/science.sof

esorex sph_ifs_science_dr --
ifs.science_dr.outfilename=./PAE/IFS_24oct13/science/ifs_science_dr.fits
/data/work/PAE/IFS_24oct13/science/flux.sof

esorex sph_ifs_science_dr --
ifs.science_dr.outfilename=./PAE/IFS_24oct13/science/ifs_science_dr.fits
/data/work/PAE/IFS_24oct13/science/starcenter.sof
```

19.2 **IRDIS**

19.2.1 _DBI_H23+H32

```
#
# DARK
#
esorex sph_ird_master_dark \
      --ird.master_dark.outfilename='dark_H23.fits' \
      --ird.master_dark.badpixfilename='dark_badpix_H23.fits' \
      dark_H23.sof

esorex sph_ird_master_dark \
```

```
      --ird.master_dark.outfilename='dark_H32.fits' \
      --ird.master_dark.badpixfilename='dark_badpix_H32.fits' \
      dark_H32.sof

esorex sph_ird_master_dark \
      --ird.master_dark.outfilename='dark_H23_psf.fits' \
      --ird.master_dark.badpixfilename='dark_badpix_H23_psf.fits' \
      dark_H23_psf.sof

esorex sph_ird_master_dark \
      --ird.master_dark.outfilename='dark_H32_psf.fits' \
      --ird.master_dark.badpixfilename='dark_badpix_H32_psf.fits' \
      dark_H32_psf.sof

#
# FLAT
#
esorex sph_ird_instrument_flat \
      --ird.instrument_flat.outfilename='flat_H23.fits' \
      --ird.instrument_flat.badpixfilename='flat_badpix_H23.fits' \
      flat_H23.sof

esorex sph_ird_instrument_flat \
      --ird.instrument_flat.outfilename='flat_H32.fits' \
      --ird.instrument_flat.badpixfilename='flat_badpix_H32.fits' \
      flat_H32.sof

#
# DISTORTION
#
esorex sph_ird_distortion_map \
      --ird.distortion_map.threshold=3 \
      --ird.distortion_map.outfilename='distmap_H23.fits' \
     distmap_H23.sof

esorex sph_ird_distortion_map \
      --ird.distortion_map.threshold=3 \
      --ird.distortion_map.outfilename='distmap_H32.fits' \
    distmap_H32.sof

#
# STAR CENTER
#
esorex sph_ird_star_center \
      --ird.star_center.sigma=500.0 \
      --ird.star_center.nsources=4 \
```

```
        --ird.star_center.outfilename='star_center_H23.fits' \
        --ird.star_center.qc=TRUE \
        star_center_H23.sof

esorex sph_ird_star_center \
        --ird.star_center.qc=TRUE \
        --ird.star_center.sigma=500.0 \
        --ird.star_center.nsources=4 \
        --ird.star_center.outfilename='star_center_H32.fits' \
        --ird.star_center.qc=TRUE \
        star_center_H32.sof

#
# SCIENCE DBI
#
esorex sph_ird_science_dbi \
        --ird.science_dbi.use_adi=FALSE \
        --ird.science_dbi.use_sdi=TRUE \
        --ird.science_dbi.coll_alg=1 \
        --ird.science_dbi.minr=20.0 \
        --ird.science_dbi.maxr=60.0 \
        --ird.science_dbi.transform_method=0 \
        --ird.science_dbi.outfilename='dbi_H23.fits' \
        --ird.science_dbi.outfilename_left='dbi_H23_left.fits' \
        --ird.science_dbi.outfilename_right='dbi_H23_right.fits' \
        --ird.science_dbi.window_size=512 \
        dbi_H23.sof

esorex sph_ird_science_dbi \
        --ird.science_dbi.use_adi=FALSE \
        --ird.science_dbi.use_sdi=TRUE \
        --ird.science_dbi.coll_alg=1 \
        --ird.science_dbi.minr=20.0 \
        --ird.science_dbi.maxr=60.0 \
        --ird.science_dbi.transform_method=0 \
        --ird.science_dbi.outfilename='dbi_H32.fits' \
        --ird.science_dbi.outfilename_left='dbi_H32_left.fits' \
        --ird.science_dbi.outfilename_right='dbi_H32_right.fits' \
        --ird.science_dbi.window_size=512 \
        dbi_H32.sof

#
# REFERENCE PSF
#
esorex sph_ird_science_imaging \
        --ird.science_imaging.use_adi=FALSE \
```

```
        --ird.science_imaging.outfilename='reference_psf_H23.fits' \
        --ird.science_imaging.outfilename_left='reference_psf_H23_left.fits' \
        --ird.science_imaging.outfilename_right='reference_psf_H23_right.fits' \
        reference_psf_H23.sof

esorex sph_ird_science_imaging \
        --ird.science_imaging.use_adi=FALSE \
        --ird.science_imaging.outfilename='reference_psf_H32.fits' \
        --ird.science_imaging.outfilename_left='reference_psf_H32_left.fits' \
        --ird.science_imaging.outfilename_right='reference_psf_H32_right.fits' \
        reference_psf_H32.sof
```

19.2.2 _DBI_J23

```
#
# DARK
#
esorex sph_ird_master_dark \
        --ird.master_dark.outfilename='dark_J23.fits' \
        --ird.master_dark.badpixfilename='dark_badpix_J23.fits' \
        dark_J23.sof

esorex sph_ird_master_dark \
        --ird.master_dark.outfilename='dark_J23_psf.fits' \
        --ird.master_dark.badpixfilename='dark_badpix_J23_psf.fits' \
        dark_J23_psf.sof

#
# FLAT
#
esorex sph_ird_instrument_flat \
        --ird.instrument_flat.outfilename='flat_J23.fits' \
        --ird.instrument_flat.badpixfilename='flat_badpix_J23.fits' \
        flat_J23.sof

#
# DISTORTION
#
esorex sph_ird_distortion_map \
        --ird.distortion_map.threshold=3 \
        --ird.distortion_map.outfilename='distmap_J23.fits' \
       distmap_J23.sof

#
```

```
# STAR CENTER
#
esorex sph_ird_star_center \
      --ird.star_center.sigma=500.0 \
      --ird.star_center.nsources=4 \
      --ird.star_center.outfilename='star_center_J23.fits' \
      --ird.star_center.qc=TRUE \
      star_center_J23.sof

#
# SCIENCE DBI
#
esorex sph_ird_science_dbi \
      --ird.science_dbi.use_adi=FALSE \
      --ird.science_dbi.use_sdi=TRUE \
      --ird.science_dbi.coll_alg=1 \
      --ird.science_dbi.minr=20.0 \
      --ird.science_dbi.maxr=60.0 \
      --ird.science_dbi.transform_method=0 \
      --ird.science_dbi.outfilename='dbi_J23.fits' \
      --ird.science_dbi.outfilename_left='dbi_J23_left.fits' \
      --ird.science_dbi.outfilename_right='dbi_J23_right.fits' \
      --ird.science_dbi.window_size=512 \
      dbi_J23.sof

#
# REFERENCE PSF
#
esorex sph_ird_science_imaging \
      --ird.science_imaging.use_adi=FALSE \
      --ird.science_imaging.outfilename='reference_psf_J23.fits' \
      --ird.science_imaging.outfilename_left='reference_psf_J23_left.fits' \
      --ird.science_imaging.outfilename_right='reference_psf_J23_right.fits' \
      reference_psf_J23.sof
```

19.2.3 _CI_H

```
#
# DARK
#
esorex sph_ird_master_dark \
      --ird.master_dark.outfilename='dark_H.fits' \
      --ird.master_dark.badpixfilename='dark_badpix_H.fits' \
      dark_H.sof
```

```
esorex sph_ird_master_dark \
      --ird.master_dark.outfilename='dark_H_psf.fits' \
      --ird.master_dark.badpixfilename='dark_badpix_H_psf.fits' \
      dark_H_psf.sof

#
# FLAT
#
esorex sph_ird_instrument_flat \
      --ird.instrument_flat.outfilename='flat_H.fits' \
      --ird.instrument_flat.badpixfilename='flat_badpix_H.fits' \
      flat_H.sof

#
# DISTORTION
#
esorex sph_ird_distortion_map \
      --ird.distortion_map.threshold=3 \
      --ird.distortion_map.outfilename='distmap_H.fits' \
     distmap_H.sof

#
# STAR CENTER
#
esorex sph_ird_star_center \
      --ird.star_center.sigma=2.0 \
      --ird.star_center.nsources=4 \
      --ird.star_center.outfilename='star_center_H.fits' \
      --ird.star_center.qc=TRUE \
      star_center_H.sof

#
# SCIENCE CI
#
esorex sph_ird_science_imaging \
      --ird.science_imaging.use_adi=FALSE \
      --ird.science_imaging.outfilename='ci_H.fits' \
      --ird.science_imaging.outfilename_left='CI_H_left.fits' \
      --ird.science_imaging.outfilename_right='CI_H_right.fits' \
      ci_H.sof

#
# REFERENCE PSF
#
esorex sph_ird_science_imaging \
```

```
    --ird.science_imaging.use_adi=FALSE \
    --ird.science_imaging.outfilename='reference_psf_H.fits' \
    --ird.science_imaging.outfilename_left='reference_psf_H_left.fits' \
    --ird.science_imaging.outfilename_right='reference_psf_H_right.fits' \
    reference_psf_H.sof
```

19.2.4 _LSS_MRS

```
#
# DARK
#
esorex sph_ird_master_dark \
    --ird.master_dark.outfilename='dark.fits' \
    --ird.master_dark.badpixfilename='dark_badpix.fits' \
    dark.sof

esorex sph_ird_master_dark \
    --ird.master_dark.outfilename='dark_psf.fits' \
    --ird.master_dark.badpixfilename='dark_psf_badpix.fits' \
    dark_psf.sof

#
# FLAT
#
esorex sph_ird_instrument_flat \
    --ird.instrument_flat.outfilename='flat.fits' \
    --ird.instrument_flat.badpixfilename='flat_badpix.fits' \
    flat.sof

esorex sph_ird_instrument_flat \
    --ird.instrument_flat.outfilename='flat_wave.fits' \
    --ird.instrument_flat.badpixfilename='flat_wave_badpix.fits' \
    flat_wave.sof

#
# WAVELENGTH CALIBRATION
#
esorex sph_ird_wave_calib \
    --ird.wave_calib.column_width=100 \
    --ird.wave_calib.grism_mode=true \
    --ird.wave_calib.threshold=1000 \
    --ird.wave_calib.outfilename='wave_cal.fits' \
    wave_cal.sof
```

```
#
# SCIENCE SPECTROSCOPY
#
esorex sph_ird_science_spectroscopy \
      --ird.science_spectroscopy.coll_alg=0 \
      --ird.science_spectroscopy.outfilename='lss.fits' \
      lss.sof

esorex sph_ird_science_spectroscopy \
      --ird.science_spectroscopy.coll_alg=0 \
      --ird.science_spectroscopy.outfilename='telluric.fits' \
      telluric.sof
```

19.2.5 _LSS_LRS

```
#
# DARK
#
esorex sph_ird_master_dark \
      --ird.master_dark.outfilename='dark.fits' \
      --ird.master_dark.badpixfilename='dark_badpix.fits' \
      dark.sof

esorex sph_ird_master_dark \
      --ird.master_dark.outfilename='dark_psf.fits' \
      --ird.master_dark.badpixfilename='dark_psf_badpix.fits' \
      dark_psf.sof

#
# FLAT
#
esorex sph_ird_instrument_flat \
      --ird.instrument_flat.outfilename='flat.fits' \
      --ird.instrument_flat.badpixfilename='flat_badpix.fits' \
      flat.sof

esorex sph_ird_instrument_flat \
      --ird.instrument_flat.outfilename='flat_wave.fits' \
      --ird.instrument_flat.badpixfilename='flat_wave_badpix.fits' \
      flat_wave.sof

#
# WAVELENGTH CALIBRATION
#
```

```
esorex sph_ird_wave_calib \
      --ird.wave_calib.column_width=100 \
      --ird.wave_calib.grism_mode=false \
      --ird.wave_calib.threshold=900 \
      --ird.wave_calib.outfilename='wave_cal.fits' \
      wave_cal.sof

#
# SCIENCE SPECTROSCOPY
#
esorex sph_ird_science_spectroscopy \
      --ird.science_spectroscopy.coll_alg=0 \
      --ird.science_spectroscopy.outfilename='lss.fits' \
      lss.sof

esorex sph_ird_science_spectroscopy \
      --ird.science_spectroscopy.coll_alg=0 \
      --ird.science_spectroscopy.outfilename='telluric.fits' \
      telluric.sof
```

19.2.6 _DPI

```
#
# DARK
#
esorex sph_ird_master_dark \
      --ird.master_dark.outfilename='dark_H.fits' \
      --ird.master_dark.badpixfilename='dark_badpix_H.fits' \
      dark_H.sof

#
# FLAT
#
esorex sph_ird_instrument_flat \
      --ird.instrument_flat.outfilename='flat_H.fits' \
      --ird.instrument_flat.badpixfilename='flat_badpix_H.fits' \
      flat_H.sof

#
# STAR CENTER
#
```

```
esorex sph_ird_star_center \
      --ird.star_center.sigma=100.0 \
      --ird.star_center.nsources=4 \
      --ird.star_center.outfilename='star_center_H.fits' \
      --ird.star_center.qc=TRUE \
      star_center_H.sof

#
# SCIENCE DPI
#
esorex sph_ird_science_dbi \
      --ird.science_dbi.use_adi=FALSE \
      --ird.science_dbi.use_sdi=TRUE \
      --ird.science_dbi.coll_alg=1 \
      --ird.science_dbi.minr=20.0 \
      --ird.science_dbi.maxr=60.0 \
      --ird.science_dbi.transform_method=0 \
      --ird.science_dbi.outfilename='dpi_H.fits' \
      --ird.science_dbi.outfilename_left='dpi_H_left.fits' \
      --ird.science_dbi.outfilename_right='dpi_H_right.fits' \
      --ird.science_dbi.window_size=512 \
      dpi_H.sof

#
# REFERENCE PSF
#
esorex sph_ird_science_imaging \
      --ird.science_imaging.use_adi=FALSE \
      --ird.science_imaging.outfilename='reference_psf_H.fits' \
      --ird.science_imaging.outfilename_left='reference_psf_H_left.fits' \
      --ird.science_imaging.outfilename_right='reference_psf_H_right.fits' \
      reference_psf_H.sof

esorex sph_ird_science_imaging \
      --ird.science_imaging.use_adi=FALSE \
      --ird.science_imaging.outfilename='reference_psf_FeII.fits' \
      --ird.science_imaging.outfilename_left='reference_psf_FeII_left.fits' \
      --ird.science_imaging.outfilename_right='reference_psf_FeII_right.fits' \
      reference_psf_FeII.sof
```

19.3 **ZIMPOL**

19.3.1 Polarimetry (fast and slow)

```
#
# polarimetry (fast and slow)
#
esorex sph_zpl_master_bias master_bias.sof
esorex sph_zpl_master_dark master_dark.sof
esorex sph_zpl_modem_efficiency modem_effiency.sof
esorex sph_zpl_intensity_flat flat.sof
esorex sph_zpl_science_p23 science_2.sof
```

19.3.2 Imaging

```
#
# imaging
#
esorex sph_zpl_master_bias_imaging master_bias.sof
esorex sph_zpl_master_dark_imaging master_dark.sof
esorex sph_spl_intensity_flat_imaging flat.sof
esorex sph_zpl_science_imaging science.sof
```